PB83-176628

Draft Environmental Impact Statement
Martin Lake D Area Lignite Surface Mine
Henderson, Rusk County, Texas

(U.S.) Environmental Protection Agency
Dallas, TX

Mar 83

U.S. Department of Commerce
National Technical Information Service
NTIS

United States
Environmental Protection
Agency

Region 6
1201 Elm Street
Dallas TX 75270

EPA 906/9-83-003
March 1983

Water

EPA

Environmental Impact Statement

Draft

PB83-176628

Martin Lake D Area Lignite Surface Mine Henderson, Rusk County Texas

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Proposed action is issuance of new source National Pollutant Discharge Elimination System permit to Texas Utilities Generating Company for mine wastewater discharges to streams.

16. ABSTRACT

TUGCO has applied for an NPDES permit for wastewater discharges from sedimentation ponds in the mine permit area to streams including Todd Branch, Boggy Branch, Dry Creek, Dogwood Creek, Boggy Creek, Mill Creek.Lignite would be mined for 30 years from 16,600 acres at 1.5 ton yearly initially, increasing to 3.5 million tons yearly in 1987. Lignite would be hauled by truck to a crusher on the mine site, then by rail for 11 miles to Martin Lake Steam Electric Station for burning. Earth would be disturbed by mining up to 150 feet depths and by ponds constructin, diversions, haul roads, railroad and transmission lines. Environmental changes include loss of topsoils, native vegetation and wildlife habitat; removal of wetlands; reduction of species diversity, water quality and stream flow changes; disruption to ground-water levels; loss of wells; land use changes. Mine spoil would be leveled be leveled for revegetation with bermuda grass and pine forest species, primarily. Area long term water quality depends on success of land reclamation and maintenance required for revegetation stability. Air and water quality control measures are proposed to reduce dust, crusher emissions, stormwater runoff, mine drainage, erosion and sedimentation. Archeological and historic sites will be lost or damaged; some sites will require recovery of significant historical data. Area health, educational,, governmental, housing and commercial service needs will increase due to induced population increases. The project is estimated to provide 240 jobs, and have a payroll of about $4,000,000 annually. The project will generate some additional taxes.

17. KEY WORDS AND DOCUMENT ANALYSIS

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

March 1, 1983

TO ALL INTERESTED INDIVIDUALS, GROUPS, AGENCIES AND OFFICIALS:

We are submitting for your review this Draft Environmental Impact Statement (EIS) on the Martin Lake "D" Area Lignite Surface Mine Project proposed near Henderson, in Rusk County, Texas by the Texas Utilities Generating Company.

We request that you comment on this statement so that an accurate Final EIS may be prepared for use by decision makers, especially regarding the issuance of the wastewater discharge permit, the National Pollutant Discharge Elimination System Permit (NPDES), required from the Environmental Protection Agency.

Sincerely yours,

Myron O. Knudson

Dick Whittington, P.E.
for Regional Administrator

Draft Environmental Impact Statement
Martin Lake "D" Area Lignite Surface Mine Project

Responsible Agency: U.S. Environmental Protection Agency Region 6

Proposed Action: Administrative - Issue new source National Pollutant Discharge Elimination System (NPDES) permit to Texas Utilities Generating Company (TUGCO) for discharge of wastewater from the Martin Lake "D" area lignite surface mine, near Henderson, in Rusk County, Texas.

Public Hearing on Draft EIS:
Tuesday, April 26, 1983
7:30 p.m.
Rusk County Courthouse, District Courtroom
115 N. Main, Henderson, Texas

Contact for Further Information:
Clinton B. Spotts, Regional EIS Coordinator
U.S. Environmental Protection Agency
1201 Elm Street, Dallas, Texas 75270
(214) 767-2716 or FTS 729-2716

Written Comments on Draft EIS Due: May 3, 1983

Abstract: TUGCO has applied for an NPDES permit for wastewater discharges from various sedimentation ponds to be located within the mine permit area. Streams receiving wastewater would include Todd Branch, Boggy Branch, Dry Creek, Dogwood Creek, Boggy Creek, Mill Creek and other unnamed tributaries. Lignite would be mined for 30 years from 16,600 acres at a rate of 1.5 million tons per year initially increasing to 3.5 million tons yearly in 1987. Lignite would be hauled by truck to a crusher at the mine site then transported by rail to Martin Lake Steam Electric Station for burning. Earth would be disturbed by mining to depths varying to 150 feet and by construction of ponds, diversions, haul roads, railroad, and transmission lines. Environmental changes include loss of existing topsoils, loss of native vegetation and wildlife habitat, removal of wetlands, reduction of species diversity, water quality and stream flow changes, disruption to ground water levels, loss of water wells, and land use changes. Mine and reclamation plans proposed include random mix of spoil for revegetation primarily with bermuda grass and pine forest species. Long term impacts would depend on success of land reclamation and level of maintenance for stability in revegetation. Air and water quality control measures are proposed to reduce fugitive dust, crusher emissions, stormwater runoff, erosion and sedimentation. Archeological and historic sites are expected to be lost or damaged; some sites will require mitigation measures for recovering significant historical data. The project is estimated to provide 240 jobs, and have a payroll of about $4,000,000 annually. The project will generate additional taxes. Area health, educational, governmental, housing, and commercial service needs will increase due to induced population increases.

Responsible Official:

Myron O. Knudson
for Dick Whittington, P.E.
Regional Administrator

1.0 SUMMARY

1.1 BACKGROUND

The National Environmental Policy Act of 1969 (NEPA) requires that all Federal agencies prepare environmental impact statements on major Federal actions significantly affecting the quality of the human environment. The Clean Water Act (CWA) mandates that the requirements of NEPA apply to the issuance of a permit for discharging any pollutant by a "New Source." The Environmental Protection Agency (EPA) has determined that the Martin Lake "D" Area Surface Lignite Mine proposed by Texas Utilities Generating Company (TUGCO) constitutes a New Source. This Environmental Impact Statement (EIS) is being prepared to assess the impacts of EPA's New Source National Pollutant Discharge Elimination System (NPDES) permit action and to disclose these impacts to the public and decision makers. EPA is required to consider public input in the EIS process before making a decision.

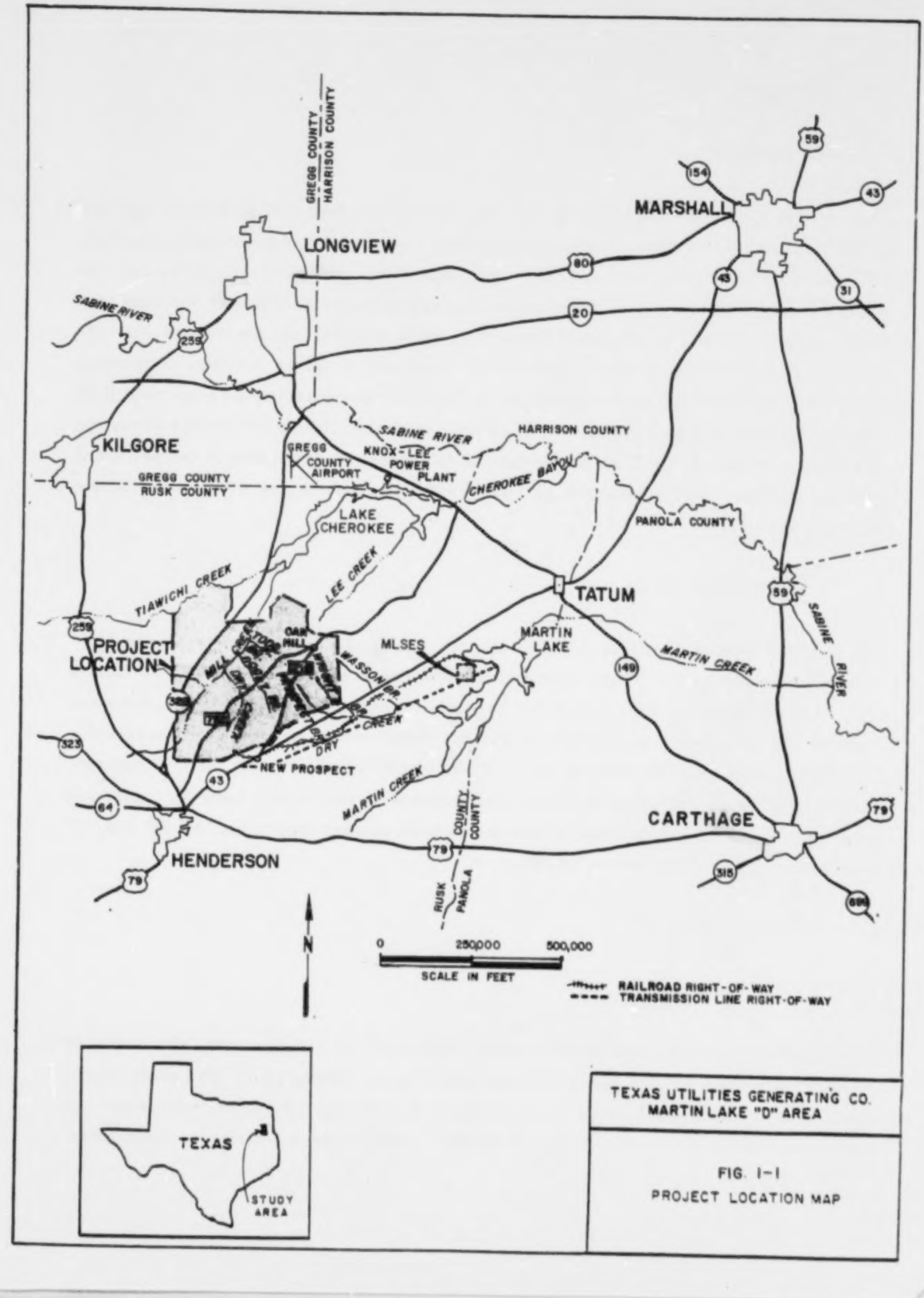
1.2 PURPOSE AND NEED

The proposed project (Fig. 1-1) would consist of a surface lignite mine as well as an 11.5-mile railroad spur and 11.5-mile transmission line connecting the mine and the Martin Lake Steam Electric Station (MLSES). The mine would supply part of the fuel source required for generation of electricity at the MLSES which presently operates three generating units (NPDES Permit No. TX-0054500) with a fourth unit tentatively scheduled to begin operation in 1991. The reserves in the Martin Lake "D" Area are proposed for balancing production with reserves from present mine areas "A", "B" and "C" and continuing generation by the MLSES.

1.3 ALTERNATIVES

1.3.1 Project Alternative

Fuel source alternatives such as geothermal, solar, nuclear and wind were eliminated by TUGCO since the project is designed to supply fuel to an existing plant. The possibility of alterations to the plant lead to the evaluation of not only lignite but natural gas and western coal as fuel sources. Alternative lignite reserves were considered. Transporta-



TEXAS UTILITIES GENERATING CO.
MARTIN LAKE "D" AREA

FIG. I-I
PROJECT LOCATION MAP

tion system alternatives were evaluated including the use of conveyors, trucks and a railroad within the mine and trucks and a railroad between the mine and power plant. Alternative routes between the mine and power plant were evaluated for the railroad and the required electric transmission line.

Bucketwheel excavator systems and draglines were evaluated as the primary overburden removal method with scrapers evaluated as a secondary method. Four alternative overburden handling procedures for draglines were evaluated on the basis of environmental impacts. These four are: (1) Mixed spoil; (2) Topsoil replacement over mixed spoil; (3) Combined topsoil and oxidized spoil over unoxidized spoil; and (4) Topsoil layer over oxidized spoil over unoxidized spoil.

Revegetation and reclamation alternatives included natural invasion, pasture only, forest, cropland and a mixture of managed pasture and woodland. Water control alternatives were evaluated for ground water and surface water and methods of discharge. Alternatives for project components such as mining sequence, ash disposal and land acquisition were also evaluated.

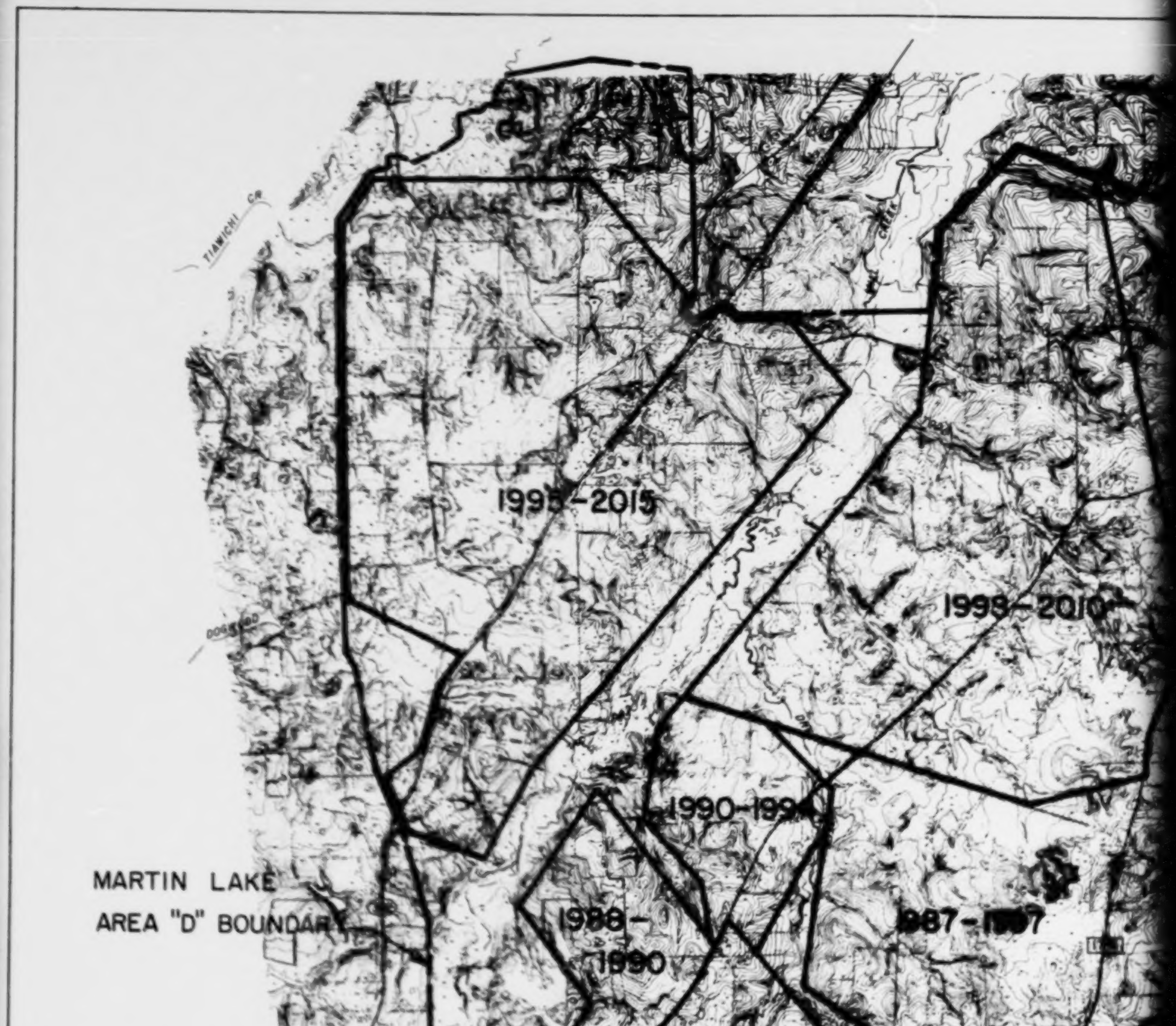
1.3.2 Other Alternatives

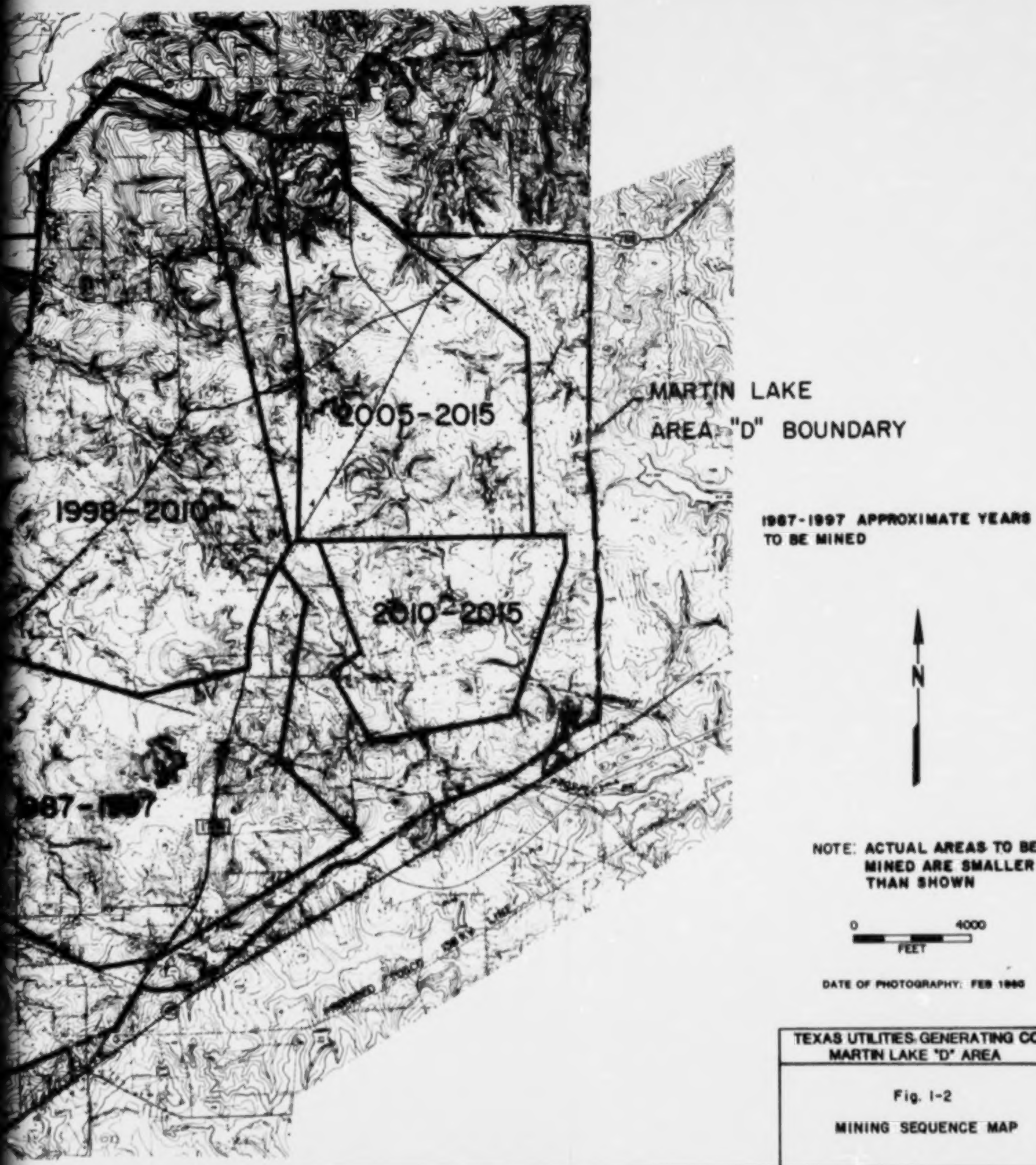
The "no action" alternative, i.e., to not develop this project, could be implemented by the permit applicant or as a result of a decision by EPA to deny issuance of a permit. Other alternatives available to EPA are to issue the permit for the project as proposed or issue the permit for the project with certain conditions to minimize or mitigate adverse impacts.

1.4 PROPOSED PROJECT

The project boundary encompasses about 24,963 acres and the extent of the lignite reserves within the boundary covers about 16,600 acres. Total tonnage to be removed during mining is about 102 million tons over a 30-year period. The general sequence of mining is shown in Fig. 1-2 which also shows generalized mining blocks. The actual areas to be mined lie within the blocks shown but are smaller.

Prior to mining, the land would be cleared of all vegetation. The development of the mine would require the construction of surface-water control facilities such as one stream


1995-2015
1998-2010
1990-1994
1988-1990
1987-1997
1985-1988
MARTIN LAKE
AREA "D" BOUNDARY


2005-2015
MARTIN LAKE
AREA "D" BOUNDARY
1998-2010
2010-2015
1987-1997
1987-1997 APPROXIMATE YEARS TO BE MINED
N
NOTE: ACTUAL AREAS TO BE MINED ARE SMALLER THAN SHOWN
0
4000
FEET
DATE OF PHOTOGRAPHY: FEB 1980

TEXAS UTILITIES GENERATING CO.
MARTIN LAKE "D" AREA

Fig. 1-2

MINING SEQUENCE MAP

diversion, catchment basins, overland flow-interceptor channels and sedimentation ponds. A 2,000-foot section of Dry Creek would be diverted for two years to allow removal of lignite under the present channel.

Overburden removal would be performed primarily by draglines. TUGCO proposes to use overburden handling alternative No. 1 (Mixed spoil). Overburden removal is scheduled to begin with one 75-cubic-yard dragline in May 1985, a second dragline in operation by April 1987 and a third in 1994. Overburden stripping panels (pits) would be 120 feet wide and vary from 3,000 to 10,000 feet long. Scrapers, dozers, front-end loaders, graders, etc., would be used, as necessary, to assist in overburden handling and lignite loading.

Trucks would haul the lignite from the pits to the train loading station over a network of haul roads. Once loaded into rail cars, the lignite would be transported to the MLSES by an electric train (Fig. 1-1). The train loading station would be located in conjunction with other permanent mine facilities which include an office, shop and warehouse building; service area; sewage treatment plant; retention pond; dragline erection site; and fuel storage facilities.

The spoil surface would be recontoured to approximately pre-mining conditions and prepared for revegetation with fertilizers and lime. Final reclamation would be to a vegetation cover of woodlands and managed pasture. The estimated proportions are 10 to 50 percent woodlands and 50 to 90 percent pasture based on present lease conditions and TUGCO policy on company-owned land. Generally, reclamation of mined lands is proposed by TUGCO to be at a level to meet surface mining regulations. Therefore, successful reclamation depends upon the enforcement of these regulations by the Railroad Commission of Texas (RRC) (delegated regulatory authority) on an individual project basis. The Office of Surface Mining, Department of Interior has overview responsibility for the state regulations. RRC regulations require productivity (yield) on reclaimed land to be at a level equal to or better than productivity on nearby premined land or according to technical standards. "Equal to" is generally defined as 90 percent of the existing productivity at a 90-percent confidence level (or 80 percent on shrub lands) based on the same level of management (see Sec. 6.2.3.4 for a more detailed definition).

1.5 ENVIRONMENTAL CONSEQUENCES

The major environmental consequences of this project and the no action alternative are shown on Table 1-1.

TABLE 1-1

ENVIRONMENTAL CONSEQUENCES

Factor	Project Alternatives	No Action Alternative
Geology and Topography	Irreversible loss of bedded geologic strata; no long-term adverse impacts to topography; short-term adverse impacts to oil and gas production; irreversible loss of clay and gravel deposits; recovery of lignite deposits; no significant cumulative effects.	No adverse impacts to geologic structure or topography.
Soils	See Table 6-1; erosion potential would be moderate, overburden handling alternatives all have good potential for success under high-level management; alternatives 1 and 3 have more potential for acid-forming material and release of heavy metals at the surface; cumulative impact of removing about 5,000 acres of prime farmland soils from potential production.	Minor continued erosion from present levels of agriculture.
Ground Water	As many as 142 wells may be lost or affected by mining; dewatering would cause long-term adverse impacts to shallow ground-water system but impacts would be largely confined to within project boundary; recharge would require 10 to 23 years; dewatering by pumping would lower water levels under artesian conditions northwest of the mine area; springs and seeps may be irretrievably lost but others may form over the long term; minor degradation to ground-water quality from increased dissolved solids; no significant cumulative effects.	None.
Surface Water	Peak flows would be decreased slightly; runoff volume not significantly affected; no significant reduction in firm yield of Lake Cherokee; dewatering would decrease baseflow in streams; could dry-up upper sections of tributaries but should not significantly affect Mill or Tiawichi creeks; minor short-term adverse impacts, mainly from suspended solids (sediment), to water quality of streams; no significant adverse impacts to Lake Cherokee; no significant cumulative effects.	None.
Wetlands and Flood Plains	About 84 acres of wetlands would be adversely affected by mining; wetlands or riparian vegetation could be adversely affected in specific areas by dewatering effects on seeps, springs and upper sections of tributaries; minor adverse cumulative impacts by reduction of wetland acreage.	Continued increase in acreage of bottomland forests despite clearing associated with mineral production, agriculture and timber production; minor adverse cumulative impacts by reduction of wetland acreage.

TABLE 1-1 (Cont'd)

Factor	Project Alternatives	No Action Alternative
Terrestrial Biology	Long-term adverse impacts related to removal of upland forest acreage with concomitant reduction of wildlife habitat; adverse cumulative impacts associated with removal of wildlife habitat.	Continued adverse impacts from clearing upland forests and reducing wildlife habitat; minor cumulative adverse impacts by reduction of upland forest acreage.
Aquatic Biology	Minor short-term adverse impacts associated with construction and operation activities.	None.
Threatened or Endangered Species	None.	None.
Archaeological and Historical Resources	Adverse effect has been determined on Walling Cabin but minimized by relocation to Henderson; determination of effect on known sites and sites yet to be discovered would be conducted at appropriate time; direct or indirect impacts on sites may be considered adverse to the resource; mitigation measures would be beneficial to state of knowledge; adverse impacts would be minimized and beneficial impacts maximized since a Memorandum of Agreement exists requiring identification and mitigation of cultural resources sites. .	Minor adverse impacts caused by local collectors, agricultural or other activities, and further natural weathering.
Air and Sound Quality	Minor adverse impacts to air quality from fugitive emissions and to sound quality from construction and operational activities. Long-term adverse secondary impacts would result from operation of the MLSES.	No action alternative would not avoid long-term adverse secondary impacts from continued operation of the MLSES.
Land Use and Recreation	Long-term impacts would result from the reduction in the amount of forested land on the site and an increase in the amount of managed pasture. Minor, short-term adverse impacts to hunting since TUGCO restricts access to its land and long-term impacts from reduced forested land.	Long-term decreases in agriculture land and upland forest with increases in pasture and residential properties; minor adverse impacts to hunting with reduced game habitat (upland forest).
Population	Short-term increases due to construction and long-term due to operation of the mine. Additional increases from secondary work force. Average age of in-migrating population would be less than existing population. No adverse impacts to area schools.	Long-term minor increases following past growth patterns.
Economy	Both short-term and long-term beneficial impacts would result directly from the project (wages, land purchases, royalties and capital expenditures); secondary beneficial impacts also would result from stimulation to the local economy.	Past economic patterns would continue.

TABLE 1-1 (Concluded)

Factor	Project Alternatives	No Action Alternative
Housing	Minor adverse impact on availability of housing from increased needs of work force; long-term beneficial impacts could occur to housing construction industry.	None.
Community Services	Short-term adverse impacts could occur from stress on water treatment and storage capacity and sewage treatment facilities in some communities but would be minor since increased need would occur over a several year period; long-term impacts would be avoided because of increased services in response to needs; long-term adverse cumulative impacts could result in combination with several other proposed projects.	None.
Transportation	No significant short-term or long-term adverse impacts to transportation systems would result because of minor traffic increases.	None.
Community Finances	Short-term and long-term beneficial impacts to municipal, county and state finances associated with tax revenues; long-term beneficial cumulative impacts in combination with other proposed projects.	None.

1.6 MAJOR ISSUES AND CONCERNS

The major issues and concerns identified by EPA and expressed by Federal, state and local agencies; organizations; and individuals during the scoping process included:

(1) Potential for contamination of major aquifers;
(2) Successful reclamation in terms of surface soil suitability and revegetation efforts;
(3) Impacts to surface-water quantity and quality;
(4) Impacts to and protection of wetlands and riparian areas;
(5) Loss of wildlife habitat;
(6) Postmining land use and reclamation impacts to wildlife habitat;
(7) Assessment of the quality of fisheries habitat;
(8) Consideration of the impacts to cultural resources;
(9) Land use changes due to reclamation;
(10) Socioeconomic impacts to communities;
(11) The effects of the work force on area schools; and
(12) Consideration of transportation systems and traffic increases.

1.7 AVAILABILITY OF EIS AND SUPPORTING MATERIAL

A copy of the draft EIS and other supporting materials are placed in information depositories at the following locations:

Rusk County Memorial Library
514 No. High Street
Henderson, Texas

Rusk County Courthouse
Office of Judge James Porter
115 No. Main Street
Henderson, Texas

Gregg County Courthouse
Office of Judge Henry Adkinson
Longview, Texas

2.0 TABLE OF CONTENTS

Chapter | Page

1.0 SUMMARY 1-1
1.1 BACKGROUND 1-1
1.2 PURPOSE AND NEED 1-1
1.3 ALTERNATIVES 1-1
1.3.1 Project Alternative 1-1
1.3.2 Other Alternatives 1-3
1.4 PROPOSED PROJECT 1-3
1.5 ENVIRONMENTAL CONSEQUENCES 1-5
1.6 MAJOR ISSUES AND CONCERNS 1-9
1.7 AVAILABILITY OF EIS AND SUPPORTING MATERIAL 1-9
2.0 TABLE OF CONTENTS 2-1
3.0 INTRODUCTION 3-1
3.1 EPA'S RESPONSIBILITY AND LEGISLATIVE AUTHORITY 3-1
3.2 OTHER FEDERAL, STATE AND LOCAL LEGISLATIVE REQUIREMENTS 3-1
3.3 DESCRIPTION OF THE APPLICANT 3-3
4.0 PURPOSE AND NEED 4-1
4.1 PURPOSE OF THE PROPOSED PROJECT 4-1
4.1.1 Nature of the Project 4-1
4.1.2 Project Purpose 4-1
4.2 NEED FOR THE PROPOSED PROJECT 4-2
5.0 DESCRIPTION AND EVALUATION OF ALTERNATIVES 5-1
5.1 ALTERNATIVES AVAILABLE TO THE APPLICANT 5-1
5.1.1 No Action 5-1
5.1.2 Fuel Resources 5-1
5.1.2.1 Natural Gas 5-1
5.1.2.2 Western Coal 5-1
5.1.2.3 Other Lignite Reserves 5-2
5.1.3 Transportation Systems and Routes 5-2
5.1.3.1 Lignite Transportation 5-2
5.1.3.2 Routes 5-4
5.1.4 Mining Methods 5-5
5.1.4.1 Bucketwheel Excavator 5-5

Chapter Page

5.1.4.2 Dragline 5-6
5.1.4.3 Comparison 5-6
5.1.5 Overburden Handling Procedures 5-7
5.1.5.1 Mixed Spoil (Applicant's proposed method) (Alternative 1) 5-10
5.1.5.2 Topsoil Replacement over Mixed Spoil (Alternative 2) 5-10
5.1.5.3 Combined Topsoil and Oxidized Spoil over Unoxidized Spoil (Alternative 3) 5-10
5.1.5.4 Topsoil Layer over Oxidized Spoil over Unoxidized Spoil (Alternative 4) 5-11
5.1.5.5 Comparison of Alternatives 5-11
5.1.6 Revegetation and Reclamation 5-11
5.1.6.1 Pasture and Woodland (Applicant's proposed alternative) 5-13
5.1.6.2 Natural Invasion 5-13
5.1.6.3 Pasture Only 5-13
5.1.6.4 Forest 5-13
5.1.6.5 Cropland 5-16
5.1.6.6 Comparison of Alternatives 5-16
5.1.7 Water Control Structures and Discharge 5-16
5.1.7.1 Ground Water 5-16
5.1.7.2 Surface Water 5-16
5.1.7.3 Solid Waste Disposal 5-17
5.1.8 Other Project Components 5-17
5.2 ALTERNATIVES PROPOSED BY APPLICANT (PROJECT DESCRIPTION) 5-18
5.2.1 Mining Reserves 5-18
5.2.2 Mining Methods and Equipment 5-19
5.2.3 Reclamation 5-26
5.3 ALTERNATIVES AVAILABLE TO EPA 5-28
5.4 ALTERNATIVES AVAILABLE TO OTHER AGENCIES 5-30
6.0 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES 6-1
6.1 GEOLOGY AND TOPOGRAPHY 6-1
6.1.1 Existing Environment 6-1
6.1.2 Impacts of No Action Alternative 6-7
6.1.3 Impacts of Project Alternatives 6-7
6.1.3.1 Geology 6-8

Chapter Page

6.1.3.2 Topography 6-8
6.1.3.3 Sensitive and Unique Geologic Conditions 6-8
6.1.3.4 Economic Deposits 6-8
6.2 SOILS AND PRIME FARMLAND 6-9
6.2.1 Existing Environment 6-9
6.2.1.1 Group I - Upland Soils of the "Redlands" Areas 6-11
6.2.1.2 Group II - Other Upland Soils with Thin Sandy Surfaces and Clayey or Loamy Subsoils 6-14
6.2.1.3 Group III - Other Upland Soils with Thick Sandy Surfaces 6-14
6.2.1.4 Group IV - Soils on Flood Plains of Local Streams 6-15
6.2.1.5 Group V - Miscellaneous Land Types 6-15
6.2.1.6 Existing Prime Farmland Soils 6-15
6.2.2 Impacts of No Action Alternative 6-16
6.2.3 Impacts of Project Alternatives 6-16
6.2.3.1 Introduction 6-16
6.2.3.2 Construction 6-17
6.2.3.3 Operations 6-18
6.2.3.4 Prime Farmland Soils 6-24
6.2.3.5 Reclamation Success 6-27
6.3 GROUND-WATER RESOURCES 6-29
6.3.1 Existing Environment 6-29
6.3.1.1 Ground-water Recharge and Movement 6-30
6.3.1.2 Hydrologic Properties of Aquifers 6-33
6.3.1.3 Ground-water Quality 6-35
6.3.1.4 Ground-water Use 6-38
6.3.2 Impacts of No Action Alternative 6-38
6.3.3 Impacts of Project Alternatives 6-38
6.3.3.1 Mining Technology and Excavation 6-38
6.3.3.2 Dewatering 6-39
6.3.3.3 Reclamation 6-44
6.3.3.4 Ground-water Supply 6-47
6.4 SURFACE-WATER RESOURCES 6-49
6.4.1 Existing Environment 6-49
6.4.1.1 General Information 6-49
6.4.1.2 Hydrologic Characteristics 6-51

Chapter Page

6.4.1.3 Water Quality 6-54
6.4.2 Impacts of No Action Alternative 6-62
6.4.3 Impacts of Project Alternatives 6-62
6.4.3.1 Peak Flows and Runoff Volumes 6-65
6.4.3.2 Normal Flows 6-71
6.4.3.3 Impacts on Firm Yield of Lake Cherokee 6-71
6.4.3.4 Water Quality 6-72
6.5 WETLANDS AND FLOOD PLAINS 6-77
6.5.1 Existing Environment 6-77
6.5.1.1 Wetland Communities 6-77
6.5.1.2 Flood Plain Communities 6-79
6.5.2 Impacts of No Action Alternative 6-79
6.5.3 Impacts of Project Alternatives 6-79
6.5.3.1 Construction Impacts 6-79
6.5.3.2 Operational Impacts 6-82
6.6 TERRESTRIAL BIOLOGY 6-86
6.6.1 Existing Environment 6-86
6.6.1.1 Vegetation 6-86
6.6.1.2 Wildlife 6-89
6.6.1.3 Important Species 6-92
6.6.1.4 Ecologically Sensitive Areas 6-93
6.6.2 Impacts of No Action Alternative 6-94
6.6.2.1 Vegetation 6-94
6.6.2.2 Wildlife 6-95
6.6.3 Impacts of Project Alternatives 6-95
6.6.3.1 Vegetation 6-95
6.6.3.2 Wildlife 6-99
6.7 AQUATIC BIOLOGY 6-102
6.7.1 Existing Environment 6-102
6.7.1.1 Aquatic Habitats 6-102
6.7.1.2 Aquatic Biota 6-103
6.7.1.3 Important Species 6-104
6.7.2 Impacts of No Action Alternative 6-105
6.7.3 Impacts of Project Alternatives 6-105

Chapter	Page
6.8 THREATENED OR ENDANGERED SPECIES	6-109
6.8.1 Existing Environment	6-109
6.8.2 Impacts of No Action Alternative	6-109
6.8.3 Impacts of Project Alternatives	6-109
6.9 ARCHAEOLOGICAL AND HISTORICAL RESOURCES	6-110
6.9.1 Existing Environment	6-110
6.9.1.1 Cultural Background	6-110
6.9.1.2 Project Specific Surveys	6-112
6.9.1.3 General Surveys	6-112
6.9.1.4 Prehistoric Properties	6-114
6.9.1.5 Historic Properties	6-115
6.9.2 Impacts of No Action Alternative	6-117
6.9.3 Impacts of Project Alternatives	6-117
6.9.3.1 National Register Sites	6-117
6.9.3.2 Sites Not Eligible for the NRHP	6-119
6.9.3.3 Agreement for Consideration of Cultural Resources	6-119
6.10 AIR AND SOUND QUALITY	6-119
6.10.1 Existing Environment	6-119
6.10.1.1 Air Quality	6-119
6.10.1.2 Sound Quality	6-120
6.10.2 Impacts of No Action Alternative	6-123
6.10.2.1 Air Quality	6-123
6.10.2.2 Sound Quality	6-123
6.10.3 Impacts of Project Alternatives	6-123
6.10.3.1 Air Quality	6-123
6.10.3.2 Sound Quality	6-128
6.11 LAND USE AND RECREATION	6-134
6.11.1 Existing Environment	6-134
6.11.1.1 Land Use	6-134
6.11.1.2 Recreation	6-139
6.11.2 Impacts of No Action Alternative	6-140
6.11.2.1 Land Use	6-140
6.11.2.2 Recreation	6-141
6.11.3 Impacts of Project Alternatives	6-141

Chapter Page

6.11.3.1 Land Use 6-141
6.11.3.2 Recreation 6-143
6.12 POPULATION 6-143
6.12.1 Existing Environment 6-143
6.12.1.1 Project-Area Population and Migration Trends 6-143
6.12.1.2 Population Characteristics 6-143
6.12.2 Impacts of No Action Alternative 6-144
6.12.3 Impacts of Project Alternatives 6-144
6.13 ECONOMY 6-146
6.13.1 Existing Environment 6-146
6.13.1.1 Labor Force and Employment 6-146
6.13.1.2 Employment by Industry 6-146
6.13.1.3 Personal Income 6-147
6.13.1.4 Leading Economic Sectors 6-147
6.13.2 Impacts of No Action Alternative 6-148
6.13.3 Impacts of Project Alternatives 6-148
6.14 HOUSING 6-154
6.14.1 Existing Environment 6-154
6.14.2 Impacts of No Action Alternative 6-154
6.14.3 Impacts of Project Alternatives 6-155
6.15 COMMUNITY SERVICES 6-157
6.15.1 Existing Environment 6-157
6.15.1.1 Police Services 6-157
6.15.1.2 Fire Protection Services 6-157
6.15.1.3 Health Services 6-158
6.15.1.4 Public Educational Services 6-158
6.15.1.5 Utilities 6-158
6.15.2 Impacts of No Action Alternative 6-159
6.15.3 Impacts of Project Alternatives 6-159
6.15.3.1 Construction Period 6-159
6.15.3.2 Operations Period 6-162
6.16 TRANSPORTATION 6-162
6.16.1 Existing Environment 6-162
6.16.2 Impacts of No Action Alternative 6-163

Chapter Page

6.16.3 Impacts of Project Alternatives 6-164
6.17 COMMUNITY FINANCES 6-165
6.17.1 Existing Environment 6-165
6.17.1.1 County Budget Summaries 6-165
6.17.1.2 Municipal Budget Summaries 6-165
6.17.1.3 County, Municipal and School District Taxation and Debt 6-165
6.17.2 Impacts of No Action Alternative 6-166
6.17.3 Impacts of Project Alternatives 6-166
6.18 CUMULATIVE IMPACTS 6-167
6.18.1 Geology and Topography 6-168
6.18.2 Soils and Prime Farmland 6-168
6.18.3 Ground-water Resources 6-168
6.18.4 Surface-water Resources 6-169
6.18.5 Ecology 6-169
6.18.6 Archaeological and Historical Resources 6-170
6.18.7 Air and Sound Quality 6-170
6.18.8 Land Use and Recreation 6-171
6.18.9 Socioeconomics 6-171
7.0 COORDINATION 7-1
7.1 SCOPING PROCESS 7-1
7.2 EIS REVIEW PROCESS 7-1
7.3 DISTRIBUTION OF THE EIS 7-1
7.3.1 Federal Agencies 7-1
7.3.2 State Agencies and Organizations 7-3
7.3.3 Public Groups 7-3
7.3.4 Distribution of the Final EIS and Record of Decision 7-4
8.0 LIST OF PREPARERS 8-1
9.0 BIBLIOGRAPHY 9-1
10.0 GLOSSARY 10-1
APPENDIX A - Section 404(b)(1) Analysis
APPENDIX B - Memorandum of Understanding, Cultural Resources
APPENDIX C - Preliminary NPDES Permit

Chapter Page

INDEX

APPENDICIES AVAILABLE AT DEPOSITORIES

APPENDIX D - Overburden Analysis Data

APPENDIX E - Lignite Analysis Data

APPENDIX F - Water Well Survey Data

APPENDIX G - Monitoring Well Data - Mining Areas "A," "B" and "C"

APPENDIX H - Surface-water Runoff and Water Quality Modeling Technical Memoranda

APPENDIX I - Settleable Matter Historic Data

APPENDIX J - The COE Wetlands Determination

APPENDIX K - Biological Assessment, Threatened or Endangered Species

APPENDIX L - Martin Lake Employee Distribution Information

LIST OF FIGURES

Figure		Page
1-1	Project Location Map	1-2
1-2	Mining Sequence Map	1-6
5-1	Comparison of Spoil Compositions	5-9
5-2	Comparison of Alternatives	5-12
5-3	Overburden to Lignite Ratios	5-20
5-4	Proposed Haul Roads	5-23
5-5	Mine Facilities and Transportation System	5-24
5-6	Loading Station Operation	5-25
6-1	Stratigraphic Column for the Project Region	6-2
6-2	Generalized Geologic Map of the Martin Lake "D" Area	6-3
6-3	East-West Strike Cross Section of Project Area	6-5
6-4	North-South Dip Cross Section of Project Area	6-6
6-5	General Soils Map	6-10
6-6	Detailed Soils	6-13
6-7	Water Well Locations	6-31
6-8	Generalized Potentiometric Surface Map of the Deeper Wilcox	6-32
6-9	Public Water Supply Systems	6-48
6-10	Approximate 100 Year Flood Plain and Watershed Divides	6-50
6-11	Mean Discharge vs. Drainage Area	6-53
6-12	SWRI Surface Water Sampling Sites	6-59
6-13	SWRI Surface Water Monitoring Sites	6-63
6-14	Clean Water Act, Section 404 Area of Jurisdiction	6-81
6-15	Vegetation Communities	6-87
6-16	Baseline Noise Monitoring Locations	6-122
6-17	Land Use	6-136

LIST OF TABLES

Table **Page**

1-1 Environmental Consequences 1-6

3-1 Federal and State Permits/Regulations/Approvals/Policies/Executive Orders/Considerations Applicable to the Proposed Martin Lake "D" Area Project 3-2

5-1 Species List and Planting Specifications for Temporary and Permanent Cover Crops 5-14

5-2 Species List and Planting Specifications for Woody Species 5-15

5-3 NSPS Effluent Limitations 5-29

6-1 Soils of the Martin Lake "D" Area 6-12

6-2 Calculated Ranges of Selected Chemical and Physical Properties Potentially Resulting from Different Overburden Handling Techniques 6-19

6-3 Summary of Pumping Test Analysis 6-34

6-4 Existing Ground-water Quality Martin Lake "D" Area 6-36

6-5 Ground-water Samples Collected by TUGCO 6-37

6-6 Projected Radius of Influence (in Feet) of Pit Dewatering by Gravity Flow 6-41

6-7 Calculated Mean Flow for Streams in the Project Area 6-43

6-8 Flow Duration Data for Gaged Streams in the Project Vicinity 6-55

6-9 Low and High Flow Frequency Data for Gaged Streams in Project Vicinity 6-56

6-10 Water Quality Data and Stream Standards Sabine River Near Beckville, Texas (USGS No. 08022040) 1975-1979 6-57

6-11 Summary of Surface Water Quality Data SWRI Monitoring Program 6-60

6-12 Comparison of Water Quality at Selected Sampling Sites on Sabine River, Lake Cherokee and Cherokee Bayou 6-61

6-13 Water Quality Data - Extremes and Means Sabine River Authority Monitoring Program 1977-1980 6-64

6-14 Representative Results of Runoff Modeling Martin Lake "D" Area 6-69

6-15 Summary of Heavy Metal Analysis on Sedimentation Discharges 6-75

6-16 Vegetation Communities Martin Lake "D" Area Project Site 6-83

6-17 Trees and Shrubs to be used as Revegetation Species for Wildlife Habitat 6-98

6-18 Sites Recommended for Further Work 6-113

6-19 Monitoring Data Summary 6-121

6-20 TSP Emission Sources at Martin Lake "D" Area Lignite Mine 6-125

LIST OF TABLES (Concluded)

Table		Page
6-21	Sound Level Contribution at 50 Feet from Center of Each Mining Activity	6-130
6-22	Estimated Mining Operational L_{dn}'s at Baseline Receptor Locations	6-133
6-23	Existing Land Use Martin Lake "D" Area Project Site	6-137
6-24	Estimated Primary and Secondary Population In-Migration During Project Construction and Operation	6-145
6-25	Estimated Project (Primary) Employment Impacts	6-149
6-26	Estimated Secondary Employment Impacts	6-150
6-27	Estimated Project Expenditures	6-152
6-28	Estimated Demand for Community Facilities as a Result of Primary and Secondary Project Population In-Migration	6-156
6-29	Municipal Sewage Treatment Facilities for Selected Cities in Rusk and Gregg Counties	6-160
G-1	Metric Conversion Factors	10-14

3.0 INTRODUCTION

3.1 EPA'S RESPONSIBILITY AND LEGISLATIVE AUTHORITY

Before discharge of any pollutant into navigable waters of the United States from designated sources in an industrial category for which performance standards have been promulgated, a new source National Pollutant Discharge Elimination System permit must be obtained from the Environmental Protection Agency. Section 511 (c) (1) of the Clean Water Act also requires that the issuance of an NPDES permit by EPA for a new source discharge be subject to the National Environmental Policy Act, which may require preparation of an EIS. Pursuant to these acts, a notice of intent to prepare an EIS on the issuance of an NPDES permit for the proposed Martin Lake "D" Area Project was issued by EPA on December 18, 1981.

This EIS evaluates project alternatives proposed by EPA as well as the project as proposed by the applicant and alternative permit actions (i.e., issuance or denial of permit) available to the EPA and other Federal agencies and the environmental effects of undertaking each of these alternatives.

The document addresses the following:

(1) purpose and need for the project;
(2) alternatives available to the permit applicant, EPA and other governmental agencies;
(3) environmental consequences of alternatives; and
(4) possible measures to mitigate adverse environmental consequences.

3.2 OTHER FEDERAL, STATE AND LOCAL LEGISLATIVE REQUIREMENTS

Various Federal, state and local laws and regulations apply to the construction and operation of the proposed surface mine. These regulations include performance standards, air emission and water discharge limitations, agency reviews and approvals, and interagency coordination. A list of these required permits and/or regulations is presented in Table 3-1.

TABLE 3-1

FEDERAL AND STATE PERMITS/REGULATIONS/APPROVALS/POLICIES/ EXECUTIVE ORDERS/CONSIDERATIONS APPLICABLE TO THE PROPOSED MARTIN LAKE "D" AREA PROJECT

Item	Responsible Agency[1]
NPDES permit under Clean Water Act (Section 402)	EPA
Section 404 permit for placement of dredge and fill material under Clean Water Act	COE
Compliance with Endangered Species Act of 1973 as amended	FWS
Compliance with the National Historic Preservation Act and Executive Order 11593	EPA, SHPO, ACHP
Compliance with Archaeological and Historic Preservation Act of 1974	EPA, SHPO, ACHP
Compliance with the Fish and Wildlife Coordination Act of 1934 as amended (1965)	FWS
Compliance with Executive Order 11990: Protection of Wetlands FWS	EPA, COE
Compliance with Executive Order 11988: Floodplain Management FWS	EPA, COE
Compliance with Secretary's Memorandum No. 1827 Revised: Statement on Land-Use Policy	SCS
Compliance with EPA Policy to Protect Environmentally Significant Agricultural Lands	EPA
Railroad Commission of Texas Surface Mining Permit	RRC
Construction Permit	TACB
Wastewater Discharge Permit	TDWR
Solid Waste Disposal Permit	TDWR
Prevention of Significant Deterioration (PSD) Review under Clean Air Act	TACB
Road Relocations	RRC, THD, CC

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[1] Abbreviations:

EPA	- Environmental Protection Agency
COE	- U. S. Corps of Engineers
FWS	- U. S. Fish and Wildlife Service
SCS	- Soil Conservation Service
SHPO	- State Historic Preservation Officer
ACHP	- Advisory Council on Historic Preservation
RRC	- Railroad Commission of Texas
TDWR	- Texas Department of Water Resources
TACB	- Texas Air Control Board
THD	- State Department of Highways and Public Transportation
CC	- County Commissioners, Rusk County

Compliance by TUGCO with state requirements was raised during the EIS scoping meeting. A request was made for the EIS to address a suit against TUGCO by the State of Texas in 1979 on behalf of the Texas Department of Water Resources and the Texas Parks and Wildlife Department. The suit alleged that unauthorized discharges of wastewater had been made into Martin Lake from TUGCO's Martin Lake Power Plant and from mining area holding ponds. On August 2, 1982, the suit was dismissed with an agreed judgement between parties. The terms of the agreement were that TUGCO would pay $300,000 in compromise and settlement of all claims, but, that TUGCO denied any non-compliance with State law or any allegation in the suit. A petition by the State of Texas on behalf of the Texas Air Control Board was filed in 1979 regarding Martin Lake Power Plant Unit 3 start-up procedures; TUGCO is contesting this action and disposition is pending.

3.3 DESCRIPTION OF THE APPLICANT

The Texas Utilities Company Systems (TUCS), a private corporation, is comprised of three operating companies: Dallas Power & Light Company; Texas Electric Service Company; and Texas Power & Light Company, that own electric generating facilities and fuel for the production of electrical energy. Texas Utilities Generating Company and Texas Utilities Services, Inc. (TUSI) are service companies that provide specialized services for jointly owned generating and fuel facilities. TUSI acts as design and construction agent for facilities, and TUGCO operates the mines and generating facilities.

TUGCO has 28 years experience in mine planning, mining and utilization of Texas lignite. TUGCO mines have produced over 120 million tons of lignite for use at four power plant sites. The Company currently operates 10 draglines at surface mines in five Texas counties. Of the 16,000 acres that have been disturbed by Company mining activities, over 12,000 acres have already been reclaimed and planted with permanent vegetative cover. Mining at the Martin Lake "A," "B" and "C" mining areas has been ongoing since 1977 with a current total of 3,500 acres mined and 2,300 acres revegetated with permanent cover. Reclaimed lands in the existing Martin Lake mining areas were reclaimed less than five years ago and, therefore, have not been released from the five-year bond period required by surface mining regulations.

TUGCO has established an experienced mine planning and environmental staff during the development and operation of its existing mines. This expertise will be utilized in the mining and reclamation of the new Martin Lake Mining Area "D". A central Company environmental staff of 17 with specialists in the fields of geology, forestry, water treatment, biology, air quality, agronomy and range and wildlife management, oversees the environmental aspects of all the Company mining and reclamation activities. There is also a permanent on-site staff of five environmental specialists at the Martin Lake Mine who manage and monitor the day-to-day reclamation activities and environmental monitoring.

4.0 PURPOSE AND NEED

4.1 PURPOSE OF THE PROPOSED PROJECT

4.1.1 Nature of the Project

The proposed lignite surface mine project described herein (Fig. 1-1) is in Rusk County. The Martin Lake "D" Area encompasses about 25,000 acres within the project boundary. The lignite reserve to a depth of 150 feet is approximately 140 million tons. Mining would be a surface operation with the lignite trucked to a loading station and hauled by train approximately 11.5 miles to the MLSES. The project would require construction of site facilities (including the train loading station), haul roads, access roads, railroad, transmission line, and surface water control facilities; and the relocation of roads, pipelines and transmission lines. TUGCO operates the MLSES in Rusk County near Tatum, Texas. The station is a mine-mouth operation with three 750-MW lignite fired generating units. Commercial operation of Unit 1 began on May 16, 1977. Units 2 and 3 began commercial operation on May 23, 1978, and April 1, 1979, respectively. A fourth unit is tentatively scheduled to be operational by 1991 but does not affect the need for or scheduling of the "D" Area.

4.1.2 Project Purpose

The Martin Lake Mining Area "D" project would supplement lignite production of the mine areas "A," "B" and "C" located primarily in Panola County that presently supply the MLSES. The "D" Area would balance production and supply additional fuel to operate the three generating units for their designed 35-year plant life (until year 2005). Areas "A," "B" and "C" began production in September 1976, December 1978 and September 1979, respectively; their supplies would be exhausted by 1995 at present usage rates. Lignite from the "D" Area mine is needed by 1985.

TUCS proposes that the loss of the MLSES generating capacity at any time before the end of its designed useful life would cause a hardship to TUCS. Conversion of Martin Lake units to other fuel types would significantly increase capital and operating costs for generation. The use of lignite reserves available in Martin Lake Area "D" is proposed to supply the additional fuel required to operate the three Martin Lake units for their designed 35-year plant life.

4.2 NEED FOR THE PROPOSED PROJECT

To operate MLSES at an average annual capacity factor of 70 percent and to maintain adequate active and permanent storage piles, Martin Lake's mining areas must cumulatively produce lignite at an approximate rate of 12 million tons per year (TPY). Existing lignite reserves in these three mining areas are insufficient to fuel MLSES for the plant's life (ca 35 years). Therefore, additional lignite reserves must be developed and placed into production by 1985 to balance the production of lignite necessary to provide a 35-year plant life.

Additional fuel could either be purchased from outside sources or developed from Company-owned reserves. Lignite deposits in Rusk County are the closest and most economic fuel source under Company control that could be developed for Martin Lake generating units. These deposits, located north of Henderson, Texas, have been designated as the Martin Lake "D" mining area but previously were designated the Mill Creek Area and were planned as the fuel source for the previously proposed Mill Creek Steam Electric Station. Deposit development would be phased such that lignite production would begin in 1985 at 1.5 million TPY, reaching 3.5 million TPY by 1987 and continuing at 3.5 million TPY through the life of the mine.

5.0 DESCRIPTION AND EVALUATION OF ALTERNATIVES

5.1 ALTERNATIVES AVAILABLE TO THE APPLICANT

5.1.1 No Action

TUGCO could choose to implement the "no action" alternative and thereby not mine the "D" Area reserve at this time. If so, the adverse and beneficial impacts on the natural and social environment (see Sec. 6.0) would not occur. Landowners would lose their royalties and TUGCO would have to accelerate plans for other mine areas or arrange to buy or lease other reserves. This would involve more time and money and, should another area be mined, impacts from mining would occur in that area. Present trends in land use could be expected to occur and impacts from natural phenomena observed over time would be expected

5.1.2 Fuel Resources

5.1.2.1 Natural Gas. Natural gas is a clean fuel, requires no storage bins or tanks, and can be piped in as needed. It is burned in simple, inexpensive, almost maintenance-free furnaces. The Fuel Use Act of 1978, as amended, restricts the use of natural gas to existing units currently using natural gas as a boiler fuel. The cost of gas as a fuel for electric utilities in Texas during 1981 averaged more than 3.5 times as much as lignite (U. S. DOE, 1981). The use of natural gas would require conversion of the existing boilers and would entail additional costs and interruption of the generating capability of the MLSES.

5.1.2.2 Western Coal. Western coal is a low-sulfur (less than 0.8 lb SO_2 per million BTU), medium-BTU (8,3000 to 10,500 BTU per lb) coal, which is available in adequate supply and can be used as fuel in an environmentally acceptable manner. Lignite has considerably more bulk and is even less economical to transport long distances; it is considered an economical alternative when associated with a mine-mouth power plant such as the proposed project. In 1981, the average cost of western coal as a fuel for electric utilities in Texas is 2.5 times the average cost of lignite (U. S. DOE, 1981). TUGCO owns lignite reserves within ten miles of the MLSES and considers use of western coal an undesirable alternative.

5.1.2.3 Other Lignite Reserves. Throughout Texas there may be as much as 23,000 million tons of near-surface lignite reserves. Some of these reserves lie close enough to the MLSES to make them feasible as a fuel source. Texas Utilities owns leases on some of these reserves and can supply fuel to its own facilities most economically by using lignite from reserves on which it holds the leases. Near the MLSES, Texas Utilities owns leases in two areas: north of Henderson and an area south of Henderson. The deposit located north of Henderson, Texas, has been designated as the Martin Lake "D" mining area but previously was designated the Mill Creek Area and was planned as the fuel source for the previously proposed Mill Creek Steam Electric Station. The deposit south of Henderson consists primarily of a thin single seam that runs deeper than the lignite in Area "D". The average overburden-to-lignite ratio is about twice the ratio in Area "D" and streams overlie the lignite in several places. The center of the deposit is approximately 24 miles from the MLSES. Area "D" is preferred by TUGCO for development as the fuel supply to the MLSES because it is much closer to the plant and the lower overburden-to-lignite ratio would provide a fuel that is easier and less expensive to mine and transport. TUGCO plans to develop the South Henderson deposit, but the schedule for development and the location of use are not presently determined.

5.1.3 Transportation Systems and Routes

5.1.3.1 Lignite Transportation.

Conveyors. Conveyors provide virtually continuous haulage of lignite but are a less flexible system than truck haulage. As mining progresses, the conveyor system must be moved and extended to serve new areas. Complete multiple systems, junctions to a main conveyor line, or the use of trucks and a single conveyor line may be required when two or more areas are mined simultaneously. The problem of conveyor breakdowns requires a system of maintenance/haul roads adjacent to the conveyor to allow for repairs and to ensure continued delivery of lignite to the mine loadout point.

The main environmental impacts associated with conveyors are right-of-way requirements, blowing dust and hazards associated with spills during malfunction and/or breakdowns. The right-of-way required is increased because of the need for associated repair/haul roads. Spillage of lignite can affect areas beyond the right-of-way and presents an increased potential fire hazard. The conveyor system is electric and no waste products are emitted beyond those associated with the generation of the electricity.

Economic factors include the high initial capital costs, costs of continual movement of the system, maintenance costs, and the cost of a sufficient truck fleet back-up system. Conveyor systems are used or projected for use especially at mines where the distance is relatively short.

Trucks. Truck haulage offers the advantage of high mobility and flexibility and provides relatively continuous delivery of lignite with the use of a large fleet even when several trucks are not available. However, within the mine boundary, trucks require a system of well designed, constructed and maintained haul roads and are at a disadvantage in wet weather. As mining progresses, the haul road system must be extended into new mining areas. Outside the mine boundary (e.g., between the mine and the MLSES), trucks would require a separate haul road. Trucks are diesel and emit the typical exhaust emissions. TUGCO has selected truck haulage within the mine area and rail haulage between the mine and MLSES.

The main environmental impacts associated with truck haulage are right-of-way requirements and dust created by truck traffic. Right-of-way width can be reduced to a minimum by careful design but must be sufficient to allow two-way traffic. Fugitive dust may be partly reduced by watering the roadways.

The major economic factors are moderate initial capital investment, cost of constructing new haul roads as mining activities move, and maintenance/repair costs. The size of the fleet of trucks may be increased over several years as production increases.

Railroad. The use of a railroad allows a low unit cost for high volume, long distance transport if the life of the mine operations is sufficiently long to absorb the high initial costs. A rail system is limited by the grade, which must be maintained to approximately 1 1/2 percent for downhill and 1 percent for uphill hauls. In addition, wide, gentle turns must be made which frequently lengthens the route and decreases the flexibility of this system. The use of rail haulage within the mine boundary is not practical but its use between the mine and power plant may be practical.

The primary environmental impacts result from right-of-way requirements and dust. The use of a diesel train is not reasonable since it would require additional use of petroleum-based fuel while electricity is readily available. Therefore, only an electric train was considered for use. Right-of-way requirements for a railroad are less than for a two-way haul road and it can be designed with no at-grade crossings so local traffic will be unaffected.

The major economic factors are the high initial cost (which requires a lengthy life of the project before it becomes financially feasible) and the need for a loading station at the mine as well as unloading facilities at the power plant. The MLSES is served by electric trains from Areas "A," "B" and "C", which would be used at the new mine site; consequently, no new facilities would be required at the plant.

5.1.3.2 Routes. Transportation routes within the mine boundary are dependent upon locations of mine pits, lignite handling facilities and any natural features which are either engineering or environmental constraints. Comparison of the three types of haulage systems shows that rail haulage is least flexible and truck haulage is most flexible.

Two basic alternative railroad routes outside the mine boundary are available: one alternative route leaves the mine facility, travels along the northern side of State Highway 43 (SH43) for approximately ten miles, crosses SH43 near the MLSES, and connects to the existing facilities area at the MLSES; the second alternative leaves the mine facility, crosses SH43 near the mine boundary, travels along the southern side of SH43 for about ten miles, and connects to the existing facilities area at the MLSES. Both alternative routes travel through similar terrain and vegetative cover and environmentally neither is preferrable to the other. The northern route (crossing SH43 near the MLSES) has greater adverse socioeconomic impacts because of the increased number of residences which would be disturbed, and is less desirable from an engineering standpoint because the crossing of SH43 near the MLSES presents greater engineering problems as does the presence of Nix Lake. TUGCO has selected the route south of SH43.

The electric transmission line has fewer engineering constraints than a railroad since it is not severely limited by grade and can be built with right angle turns. The major environmental impacts are associated with right-of-way requirements while the main economic factors are associated with overall length, number of substations and the increased cost of angles in the line. Three basic alternatives were evaluated: a line between the MLSES and the mine not associated with any existing transmission line or the planned railroad, a line which partially used the railroad right-of-way and a line which partially used an existing transmission line right-of-way. The first alternative would require a 100-foot right-of-way and was discarded because it would result in the more severe adverse environmental impacts since it would affect 28 acres more than either of the other two alternatives. The second (adjacent to the railroad) and the third (adjacent to an existing line) alternatives would result in less adverse environmental impacts (only about 80 feet of right-of-way compared to 100 feet). Comparison of these two shows that a transmission line adjacent to the railroad would be very expensive because of the angle changes required to follow the railroad right-of-way. A transmission line presently exists which leaves the MLSES and travels west forming part of the southeastern boundary of the project. TUGCO selected the new transmission line alternative which uses part of this existing right-of-way from the MLSES to the project boundary because of environmental and economic advantages.

5.1.4 Mining Methods

Overburden is the soil, rock and any other material (consolidated or unconsolidated) which overlie the lignite deposits. In the project area the overburden is unconsolidated and, thus, it would very likely collapse into the cavity created by removing the lignite by underground mining methods. The potential collapse of the overburden would make underground mining very dangerous during lignite removal and would cause problems during reclamation (and later) due to subsidence. The lignite seams in this area are about seven to ten feet thick. To prevent collapse of the overburden, the upper part of the seam and/or columns (pillars) of lignite would have to be left undisturbed. This would reduce the percent recovery of the resource. Considering the danger and problems from subsidence and the reduced resource recovery rate for underground mining, surface strip mining is the most reasonable alternative mining technique for this project.

For this project, two alternative overburden removal methods were considered. These are the use of bucketwheel excavators or the use of draglines. In addition to these, a surface mine requires a variety of other equipment such as scrapers, dozers, front-end loaders, backhoes, trucks, etc. The need for additional equipment is essentially the same for both methods and does not affect a comparison of the two.

5.1.4.1 Bucketwheel Excavator. A bucketwheel excavator (BWE) is a continuous digging machine consisting of a loading boom which has a rotating wheel at the end with small buckets attached to the periphery of the wheel. As the wheel is pressed into the material to be excavated, the buckets scoop material and discharge it onto a conveyor on the boom. The loading conveyor discharges its contents onto another (discharge) conveyor mounted on a second boom. The discharge conveyor typically dumps its contents onto a system of conveyor belts. The total BWE system may include as many as six or seven pieces of equipment (BWE, beltwagon, traveling hoppers, conveyors, etc.). Mine plans usually require across-the-pit or around-the-pit conveyance for spoil replacement.

5.1.4.2 Dragline. A dragline is an excavating machine that uses a bucket operated and suspended by cables, one of which hoists or lowers the bucket. The second, from which the name is derived, allows the bucket to swing out from or to be dragged toward the machine for loading. A dragline rarely requires additional equipment since the loaded bucket is lifted and swung to the point of spoil replacement and emptied. Typcially, the angle through which the boom swings before emptying is 45 degrees or less. A dragline is not considered a continuous digging machine since a single cycle of load, lift, swing, empty, swing, ready-to-load occupies approximately 60 seconds.

5.1.4.3 Comparison. Both the BWE system and the dragline are feasible overburden removal equipment. Each has certain advantages and disadvantages (Bueyrus-Erie, 1982; Mattern, 1979; Price et al., 1973) and, to a certain extent, the advantages of one are the disadvantages of the other. Comparison of the two shows the following:

	BWE System	Dragline
(1)	Continuous mining.	Discontinuous.
(2)	Wide variety of operational heights.	Same.
(3)	Delivery of material above and below machine working level.	Only delivery below working level.
(4)	Adaptable to wide range of haulage systems.	Additional haulage systems not required.
(5)	Spoil pile continuous and easily graded to contour.	Multiple spoil piles that require more grading.
(6)	Capable of selective mining and separation of layers.	Less capable of selective mining.
(7)	Lower overall operating efficiency (60 percent).	Operating efficiency higher (+85 percent).
(8)	Large rocks create maintenance problems.	Less problems with large rocks.
(9)	Large maintenance/labor force.	Smaller maintenance/labor force.

(10)	Higher capital cost per annual output.	Lower capital cost per annual output.

For this project, several of the factors compared above are similar between the two methods; some are not significant. Continuity of mining is not important since the critical factor is volume of overburden moved per unit time and both types of equipment can be sized to obtain the necessary volume. The variety of operational heights is basically equivalent and the need for haulage systems is relatively unimportant.

Other factors are potentially important, especially for reclamation and economy of operation. The capability of delivering spoil above the machine working level and an easily graded, continuous spoil pile could be beneficial during reclamation but are not major factors in favor of bucketwheel excavators. Selective mining and the ease of separation of layers could be a very important factor affecting reclamation. For this project, however, the layers which might be important to selectively handle (the topsoil, if required, and thin, discontinuous layers of pyritic material (Sec. 5.3)) could not be efficiently or effectively handled by a BWE sized to move the required volume of overburden. The lower operating efficiency of 60 compared to 85 percent (Bucyrus-Erie, 1982), the larger maintenance/labor force and the higher capital cost per annual output for BWE systems all are factors in favor of the use of draglines for this project. Capability for efficiency and maintenance is also affected by the particular management of a given mining operation.

The impacts to the material environment from the two types of equipment should be similar. Stripping overburden requires clearing vegetation from about a 200-foot wide strip of land ahead of each mine pit. That acreage, plus the spoil sites and graded but non-revegetated areas have high erosion potential. Besides removing the surface soil, erosion adds to the sediment load of streams thereby adversely affecting water quality and possibly affecting wetlands and flood plain habitat. Removal of vegetation destroys wildlife habitat. Overburden stripping disrupts the geologic stratification and adversely affects ground water discharge and recharge. For this project, neither type of equipment is significantly beneficial to reclamation success. These, and other impacts, are thoroughly discussed in Chapter 6.0.

5.1.5 Overburden Handling Procedures

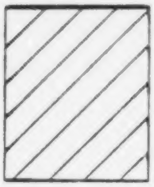
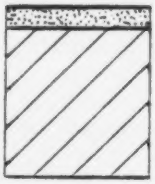
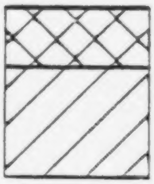
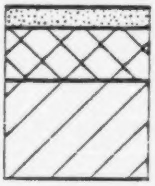
Four alternative overburden handling procedures have been evaluated. These four are: (1) Mixed overburden (spoil) (Applicant's proposed method); (2) Topsoil replacement over mixed overburden (spoil); (3) Combined topsoil and oxidized spoil over unoxidized spoil; and (4) Topsoil layer over oxidized spoil over unoxidized spoil. The oxidized layer is that layer of overburden normally above the water table in which oxidation of chemical constituents is essentially complete. Figure 5-1 is a schematic repesentation of the spoil resulting from these four alternatives.

Features common to all four alternatives include:

(1) Mining operations would be conducted as a series of parallel cuts (pits) excavated in sequence. Typically the pits would be about 120 feet wide and may be one mile or more in length with the depth varying according to overburden thickness. As mining progresses, spoil from the pit being excavated would be placed into an adjacent area of the last pit excavated. The dragline would remain at the surface level, moving backward and excavating overburden immediately in front of itself.

(2) The lower portion of overburden would be cast in the same manner in all alternatives so the final reestablishment of the water table and the general ground-water regime would be similar. If differences occur, they will be related mostly to the rate of infiltration from the surface.

(3) Portions of the lower levels of the overburden contain pyrite and/or other materials which form acidic compounds when oxidized but otherwise are comparatively inert. Any pyrites or other potentially acid-forming materials detected would be buried during overburden removal. Once oxidized, these materials have three potentially adverse consequences. First, at the surface, acidic material lowers the soil pH and can retard or prevent plant growth, thus affecting revegetation success. Second, as acidic water infiltrates the ground, it may release (i.e., leach) components (e.g., aluminum, manganese or iron) which are not released under less acidic conditions. Near the surface these components may interfere with plant growth and revegetation success. As water permeates to the subsurface layers, the components may contaminate ground water. Third, surface acidic conditions may result in contamination of surface water and/or lowering surface water pH.

HANDLING ALTERNATIVE	RESULTING SUBSURFACE COMPOSITION	
1. Mixed Spoil		Mixed Spoil
2. Topsoil Placement over Mixed Spoil		-Topsoil -Mixed Spoil
3. Combined Topsoil and Oxidized Spoil over Unoxidized Spoil		-Topsoil plus Oxidized Spoil -Unoxidized Layer
4. Topsoil Layer over Oxidized Spoil over Unoxidized Spoil		-Topsoil -Oxidized Spoil -Unoxidized Spoil

Texas Utilities Generating Co.
Martin Lake "D" Area

Fig. 5-1
SCHEMATIC
COMPARISON OF SPOIL COMPOSITIONS

Consequently, the main objective in considering alternative overburden handling procedures is to explore possible means to prevent (as much as possible) the potential adverse impacts to reclamation success and water quality. None of the alternatives is totally without the potential for these problems.

5.1.5.1 Mixed Spoil (Applicant's proposed method) (Alternative 1). The overburden is excavated in a single stage of removal and replaced in the adjacent pit. The dragline always remains at the surface level. When a zone or layer of pyritic or acid-forming material is identified (from color differentiation, log data or sampling), it would be replaced at or near the bottom of the pit. No other sorting or selection of overburden material is planned. During reclamation, the surface layer of the spoil would be graded and contoured in preparation for revegetation.

5.1.5.2 Topsoil Replacement over Mixed Spoil (Alternative 2). This procedure involves replacing a layer of segregated topsoil over a surface formed by recontouring the spoil. It requires an initial stripping of the topsoil by scrapers before removing the rest of the overburden with a dragline. Overburden removal and spoil replacement proceed as discussed above (Sec. 5.1.5.1). The dragline is within a few feet of the surface level, i.e., sitting on the surface created by removing topsoil. Grading and initial contouring also proceed as above but the final step prior to reclamation is replacement and final contouring of the topsoil. The length of time between initial land clearing and revegetation is increased by the need to strip the topsoil and replace it over the contoured overburden.

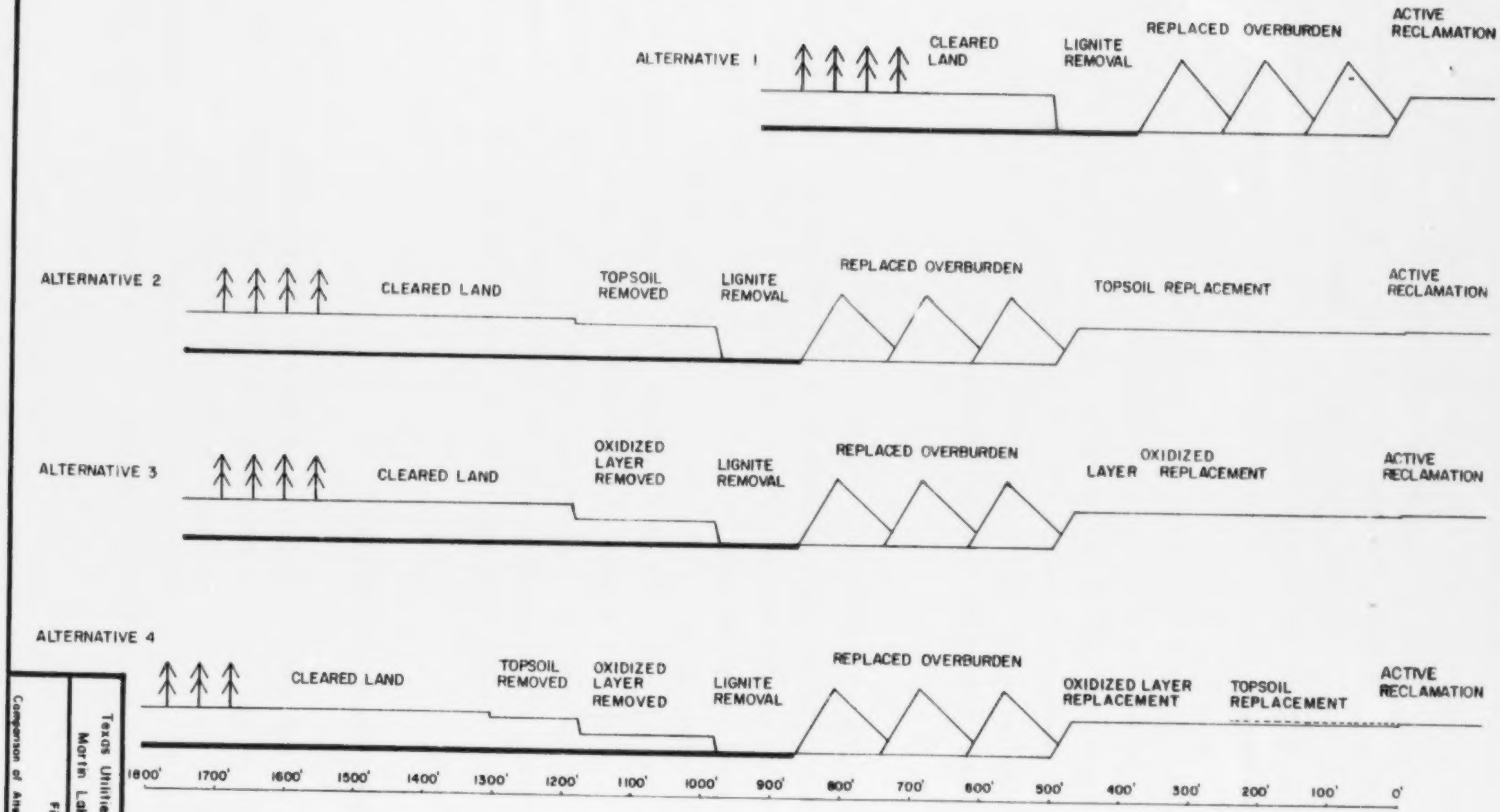
5.1.5.3 Combined Topsoil and Oxidized Spoil over Unoxidized Spoil (Alternative 3). This alternative requires a two-phased removal of the overburden. The first phase requires the removal of the oxidized zone of overburden while the second is the removal of the rest of the overburden. This method requires the dragline to be below the surface level for most of the operation. Removal of the first portion of overburden could be accomplished either by scrapers or by the dragline. Removal by scrapers costs more than removal by the dragline. Removal by the dragline, although less expensive than by scrapers, offers engineering and operational problems. Draglines are designed to operate most efficiently and cost-effectively when removing material lower than the base of the dragline. Alternative 3 requires removal of material above the base of the dragline and significantly reduces the efficiency of the dragline during this part of the operation. The dragline operation is most efficient when the dragline boom must move laterally through only about a 45 degree angle. Removal of the top portion for this method requires a boom movement through a 180 degree angle and this phase of the operation is less efficient. Removal of the oxidized layer with a dragline would require that the oxidized spoil be placed on spoil peaks. During leveling of the peaks, the oxidized spoil would be pushed into valleys between the peaks, resulting in irregular depths and some areas without oxidized material. Scrapers could replace oxidized spoil at a constant depth over previously leveled spoil peaks. Once the oxidized layer of overburden is replaced over the unoxidized layer, reclamation proceeds as discussed above (Sec. 5.1.5.1).

5.1.5.4 Topsoil Layer over Oxidized Spoil over Unoxidized Spoil (Alternative 4). This alternative is a combination of the second (Sec. 5.1.5.2) and third (Sec. 5.1.5.3) alternatives described above. It requires first stripping the topsoil, second removing the oxidized layer, and third removing the remaining overburden. Replacement is in reverse order with topsoil being replaced at the surface and results in an arrangement of material that is most like the undisturbed overburden. It entails the advantages and disadvantages of both alternatives.

5.1.5.5 Comparison of Alternatives. Each alternative has advantages and disadvantages. Alternative 1 has the greatest potential for adverse impacts to soil pH, formation of acid runoff and contamination of surface- and ground-water systems although it allows initial reclamation to proceed with the least delays but may have longer-term problems associated. Alternatives 2 and 4 have the least potential for reduced soil pH and water contamination but greater potential for problems with reclamation caused by compaction by scrapers of the upper subsurface layer during topsoil replacement. These two alternatives have greater potential for more rapid establishment of vegetation. More detailed comparison of impacts dependent upon the overburden handling procedure can be found in Secs. 6.2.3, 6.3.3, 6.4.3 and 6.18, and a visual comparison of alternatives is provided in Fig. 5-2.

5.1.6 Revegetation and Reclamation

The surface contour would be regraded to approximate pre-mining topography. After mining, dozers would be used to smooth the spoil ridges and graders would be used for final grading of the surface. All spoil would be recontoured as soon after mining as practical. Runoff would be directed, through sedimentation control structures, to the same surface water bodies as before mining, i.e., Mill Creek, Todd Branch, Dry Creek, etc.



Texas Utilities Generating Co
Martin Lake "D" Area

Fig. 5-2

Comparison of Alternatives

Another aspect of reclamation is the reconstructed soil resulting from the overburden handling procedures (as discussed in Sec. 5.1.5). Successful reclamation might require different levels and types of management depending upon the overburden handling procedure used. Techniques would include regrading and the use of soil conditioners such as lime, mulches and fertilizer.

The primary objective of revegetation operations is to establish an enduring, self-propagating and ecologically sound vegetative cover consistent with the approved postmining land use. The endurance and stability of any vegetative cover is directly related to the capability of the reconstructed soil. Tables 5-1 and 5-2 contain lists of species for potential use in the project area including temporary and permanent cover crops and woody species. Several revegetation alternatives are discussed below.

5.1.6.1 Pasture and Woodland (Applicant's proposed alternative). Temporary vegetative cover would be established to reduce erosion. Either warm or cool season species would be used, as necessary. In areas where woodlands are planned, woody species would be planted in the cover crop. Wooded areas would be located primarily along stream courses and steeper slopes. Approximately 10 to 50 percent of a given acreage would be planted to woodland but the exact locations cannot be determined at this time. The final vegetative cover for any given area would be determined based upon proposed post-mining land use according to the regulatory requirements of the RRC.

5.1.6.2 Natural Invasion. Natural invasion relies upon natural revegetation by native species. This alternative would require long periods of time for complete revegetation and provides uncertain success.

5.1.6.3 Pasture Only. Reclamation to manage pasture only generally produces consistent results at a moderate cost. Pasture has commercial value for livestock production but offers a lesser diversity of vegetative cover desirable for wildlife habitat than some other alternatives.

5.1.6.4 Forest. Revegetation of woody species throughout the disturbed areas would be difficult to accomplish and relatively expensive. A high degree of management would be required for the initial period. This alternative would provide less commercial value to landowners than some alternatives. This alternative would require first planting a cover crop to control erosion, followed by planting woody species. The time period for

TABLE 5-1

SPECIES LIST AND PLANTING SPECIFICATIONS FOR TEMPORARY AND PERMANENT COVER CROPS

Species	Method of Planting	Seeding Rate (lb PLS[1]/acre)	Planting Dates
COOL SEASON			
Ryegrass, annual	Drill	25[2]	9/1-2/28
Oats	Drill	80	9/1-12/30
Subterranean clover	Broadcast	3	9/15-12/30
Crimson clover	Broadcast	30	9/1-12/30
Yuchi clover	Broadcast	10	9/1-12/30
WARM SEASON			
Common bermudagrass	Broadcast	2	3/1-9/1
Sudangrass	Broadcast	20	4/1-9/1
Weeping lovegrass	Broadcast	3	3/1-9/1
Annual lespedeza	Broadcast	15	4/1-6/15
Partridge pea	Broadcast	10	4/1-6/15
Kleingrass	Drill	2	2/1-4/30
Coastal bermudagrass	Sprig/Broadcast	20/50 bushels	3/1-9/1

[1] Pure Live Seed.

[2] For plantings during the period 1/1-2/28, use 40 lb PLS/acre.

Source: Martin Lake Mine Permit Application.

TABLE 5-2

SPECIES LIST AND PLANTING SPECIFICATIONS FOR WOODY SPECIES

Species	Acceptable Spacing (feet)	Site Characteristics
Loblolly Pine	6 x 6-10 x 9	Medium- to heavy-textured soils, fair to poor surface drainage.
Shortleaf Pine	6 x 6-10 x 9	Coarse- to medium-textured soils, good to excessive surface drainage, plant in areas of high fusiform rust incidence.
Slash Pine	6 x 6-10 x 9	Deep, coarse- to medium-textured soils, good to excessive surface drainage.
White Oak	6 x 6	Well-drained soils.
Southern Red Oak	6 x 6	All soils, but heavy textures with poor drainage.
Water Oak	6 x 6	Poorly drained soils.
Sweetgum	6 x 6	All soils, best growth on well-drained, medium-textured soils.

Source: Martin Lake Mine Permit Application.

development of relatively mature trees would be about 15 years, at which time the trees should be in excess of 20 feet tall and would be considered "pole-sized" but not fully mature (Walterscheidt, 1983).

5.1.6.5 Cropland. The area to be mined does not contain large areas of cropland and the native soils are not appropriate for sustained crop production. Depending upon the crop, this alternative may provide very little wildlife habitat but could provide significant forage area.

5.1.6.6 Comparison of Alternatives. Natural invasion has been rejected based upon the long time period and exclusion by surface mining regulations. An appropriate reclamation plan would include a high rate of success; applicability to local needs, desires and conditions; provision of acceptable wildlife habitat; and reasonable management costs. While all four remaining alternatives fulfill one or more of these criteria, the criteria are best fulfilled by a combination of pasture and woodland. The proposed post-mining mixture is 50 to 90 percent pasture and 10 to 50 percent woodland for the overall area. This mixture would not occur on every individual acre.

5.1.7 Water Control Structures and Discharge

5.1.7.1 Ground Water. Ground water may be controlled by either a dewatering well network or sump pumps. In actual practice, ground-water control is a combination of these methods. In areas with shallow overburden and minimal ground water, it is feasible to control ground water by the use of sump pumps in the active pit. This control system, when effective, causes the least disruption to the ground-water system. With deeper overburden and larger ground-water quantity, sump pumps alone would not control the ground-water problems and the use of a dewatering well network is necessary to stabilize the highwall. This causes a more widespread disruption of the ground-water system.

For this project, it would be possible to use sump pumps alone in some areas but in other areas the use of a dewatering well network combined with sump pumps would be required.

5.1.7.2 Surface Water. Control of surface water may be accomplished through the use of runoff retention structures and drainage ditches and by diversions of streams when required. The discharge from retention structures and drainage ditches is required by RRC regulations to meet effluent limitations set forth in the NPDES permit. The effluent limitations to be met for this project are discussed in Sec. 5.3. The design specifications and performance standards for such structures are dictated by the RRC regulations which also state that after mining the sedimentation ponds and other control structures must be renovated to meet criteria specified in the detailed design plan.

Surface-water discharge for this project would primarily be to Mill Creek directly or through various tributaries. Discharge from sedimentation ponds or drainage ditches would occur to Todd Branch, Boggy Branch, Dry Creek, Dogwood Creek, Boggy Creek and several unnamed tributaries. Discharge would not occur to all tributaries at the same time but would change locations as mining proceeded incrementally. Prior to release from bond, the ponds and ditches would be renovated or reclaimed.

Alternatives for activities in or near streams are more flexible. One alternative is to avoid mining very near or through any stream (non-diversion). If a stream is disturbed, two alternatives exist: temporary diversion and permanent diversion. Obviously, non-diversion has the least adverse impacts on the surface-water system. The alternative chosen for each stream in a project area must be dictated by an analysis of the likely adverse impacts and the needs of the project. For this project, a 2,000-foot section of Dry Creek would be temporarily diverted for approximately two years within the first five years.

5.1.7.3 Solid Waste Disposal. The lignite to be mined from Area "D" contains approximately 6.78 percent ash that will require disposal after the lignite is burned in boilers at the power plant. The 100 million tons of lignite to be mined over the life of the mine would contain about 6.8 million tons of ash which would occupy approximately 120 acres of landfill. TUGCO is authorized by Texas Department of Water Resources Solid Waste Registration No. 31277 to dispose of power plant solid wastes in landfills located on the plant property and within the "A" mining area (four miles east of Martin Lake Plant). TUGCO has no plans to dispose of ash in Area "D".

5.1.8 Other Project Components

Many possible mining sequences exist. The final sequence used for any portion of the mine area must be decided upon during the late planning stages. A general sequence of mine blocks is shown in Fig. 1-1. Normally, a mining sequence begins in an area which requires the least amount of time and capital investment to produce lignite. As mining progresses, it moves into areas which are more costly to mine. Eventually, in this project, three active mining areas would exist. The sequence can affect the severity of impacts to certain environmental parameters such as dewatering, ground-water recharge, stream base flow, wetlands, etc. The impacts of the project on each of these are discussed in Chapter 6.0.

TUGCO must either own or lease lignite mineral rights on a property before surface mining can take place. It should be noted that property can be acquired by condemnation for transmission lines but not for mining. The surface ownership may be purchased by TUGCO prior to mining or retained by the current surface owner. The regulatory requirements for reclamation are identical whether property is leased or owned in fee by TUGCO (see Secs. 6.2.3.5, 6.3.3.1, 6.3.3.2 and 6.11.3.1 for reclamation information). If the landowner retains the surface ownership, he would not have access to the property for a minimum of seven to ten years during the mining and mandatory reclamation period. He would be compensated at fair market value for loss of surface structures such as houses, fences and water wells. If the surface is purchased, TUGCO assumes the responsibility for property taxes during the mining and reclamation period. Since TUGCO is a privately-held corporation, it would be subject to property taxes on all properties and facilities. TUGCO has been obtaining lignite leases within the project area since the early 1960s and is continuing to obtain additional leases. The Company has purchsed in fee approximately 5,460 acres of property within the project area and the railroad right-of-way. This consists of about 20 percent of the project area and almost 100 percent of the railroad right-of-way. Easements would be obtained for the transmission line between the mine and plant rather than purchasing the property. After regulatory requirements are completed for reclamation, property control would be returned to the surface owner after the lease agreements were met. Disposition of TUGCO-owned land, upon completion of mining and reclamation, would include sale to private individuals.

5.2 ALTERNATIVES PROPOSED BY APPLICANT (PROJECT DESCRIPTION)

5.2.1 Mining Reserves

The project boundary has been reduced since EPA issued the Notice of Intent on December 18, 1981. The boundary change primarily excluded part of the flood plain of Mill Creek on the northern side of the project. The extent of in-place lignite reserves covers approximately 16,600 acres. Total in-place tonnage to a depth of 150 feet is approximately 140 million tons. These reserves would provide for approximately a 30-year mine life. Although an estimated 140 million tons of lignite are present within the project boundary, it is assumed that some lignite may be left in various buffer zones and sensitive areas such as cemeteries, roads and villages. It is further assumed that the mining recovery factor will be 85 percent. Therefore, approximately 102 million tons of lignite are projected to be recovered during the 30-year mining period. Recoverable tonnage is based on an average yearly tonnage requirement of 3.5 million tons at full production to be delivered to the generating facility. The anticipated tonnage buildup is 1.5 million tons in 1985 (first year), 2.5 million tons in 1986 and 3.5 million tons from 1987 through the last year of operation.

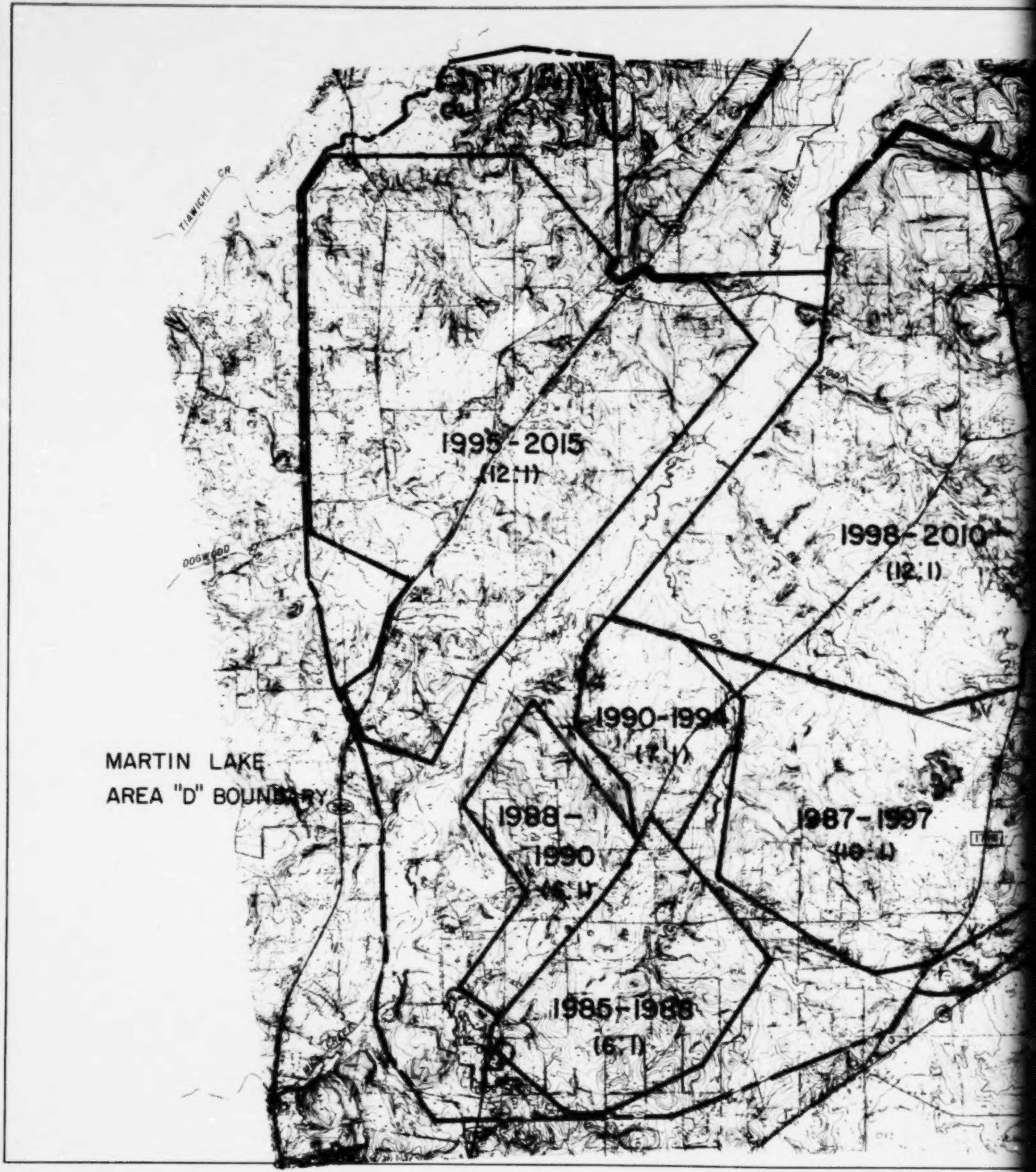
5.2.2 Mining Methods and Equipment

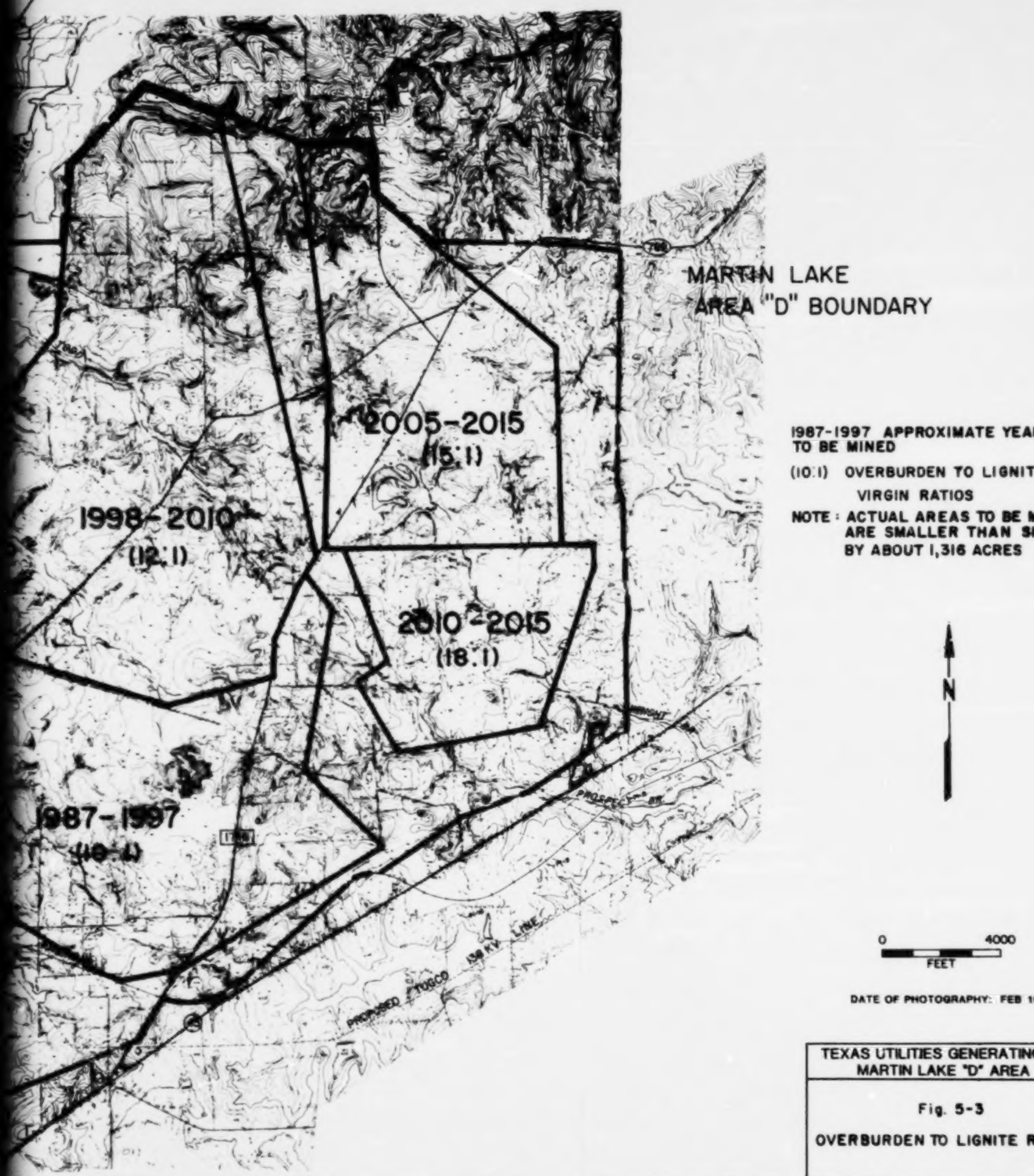
The general sequence of mining and overburden-to-lignite ratios are shown in Fig. 5-3. The requirements in developing the mining sequence were to begin mining in an area with the most favorable overburden removal ratio, and to progress toward increasingly higher ratios. The areas to be mined total approximately 15,000 acres and lie within the mine blocks shown (which total 17,916 acres). Areas within the blocks which would not be mined include most roads, cemeteries and the flood plains of most streams.

Some stands of pine and hardwood timber exist on parts of the "D" Area that are to be mined. All marketable timber would be sold and removed prior to overburden removal. Thereafter, stumps and underbrush would be removed by dozers and pushed into mined-out pits to be covered by overburden. This would be a continuous operation in advance of the overburden removal to minimize the amount of disturbed area as mining progresses.

Development of the Martin Lake "D" Area mine would require the construction of surface-water control facilities including the diversion of a portion of Dry Creek, catchment basins, overland flow-interceptor channels and sedimentation ponds. These measures would be necessary to minimize interruptions of mining activities due to flooding and to comply with the state and Federal mining regulations regarding protection of the hydrologic balance. Mine pit areas would be away from flood plains of major creeks in the area.

Overland flow would be controlled during mining operations to prevent runoff from entering active mine pits. Combinations of diversion ditches, diversion dikes and


TIAWICHI CR
CREEK
1995-2015
(12:1)
1998-2010
(12:1)
DOGWOOD
1990-1994
(7:1)
MARTIN LAKE
AREA "D" BOUNDARY
1988-
1990
(6:1)
1987-1997
(10:1)
1985-1988
(6:1)



1987-1997 APPROXIMATE YEARS TO BE MINED

(10:1) OVERBURDEN TO LIGNITE VIRGIN RATIOS

NOTE: ACTUAL AREAS TO BE MINED ARE SMALLER THAN SHOWN BY ABOUT 1,316 ACRES

DATE OF PHOTOGRAPHY: FEB 1980

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MARTIN LAKE "D" AREA

Fig. 5-3

OVERBURDEN TO LIGNITE RATIOS

catchment basins formed by dams and excavations would be temporarily located at various stages during the life of the mine for surface-water runoff control. As mining progresses, runoff toward the mine pits would be diverted around the pits, or, in cases where diversion ditch excavations would be too great, catchment basins would be constructed to capture runoff water upstream of the mine pits. If necessary, runoff water in the catchment basins would be pumped to a ditch to convey the water downstream toward natural streams in order to provide sufficient storage for subsequent runoff. Runoff from disturbed areas, however, would be diverted into sedimentation ponds. Temporary overland flow-diversion ditches would be designed to carry the peak flow rate produced by a 2-year storm, and permanent overland flow-diversion ditches would be designed for a 10-year storm. Road drainage structures would be required to allow storm runoff and stream baseflow to pass downstream without eroding the road. Culverts and bridges would be designed to pass the required storm runoff and spaced according to road class and grade in compliance with the RRC's surface mining regulations. Surface-water control facilities would be removed at various times during the life of the mine to correspond with the progression of mining and reclamation activities, with the exception of those facilities that may remain with the consent of landowners and approval by the RRC as being compatable with approved post-mining land use.

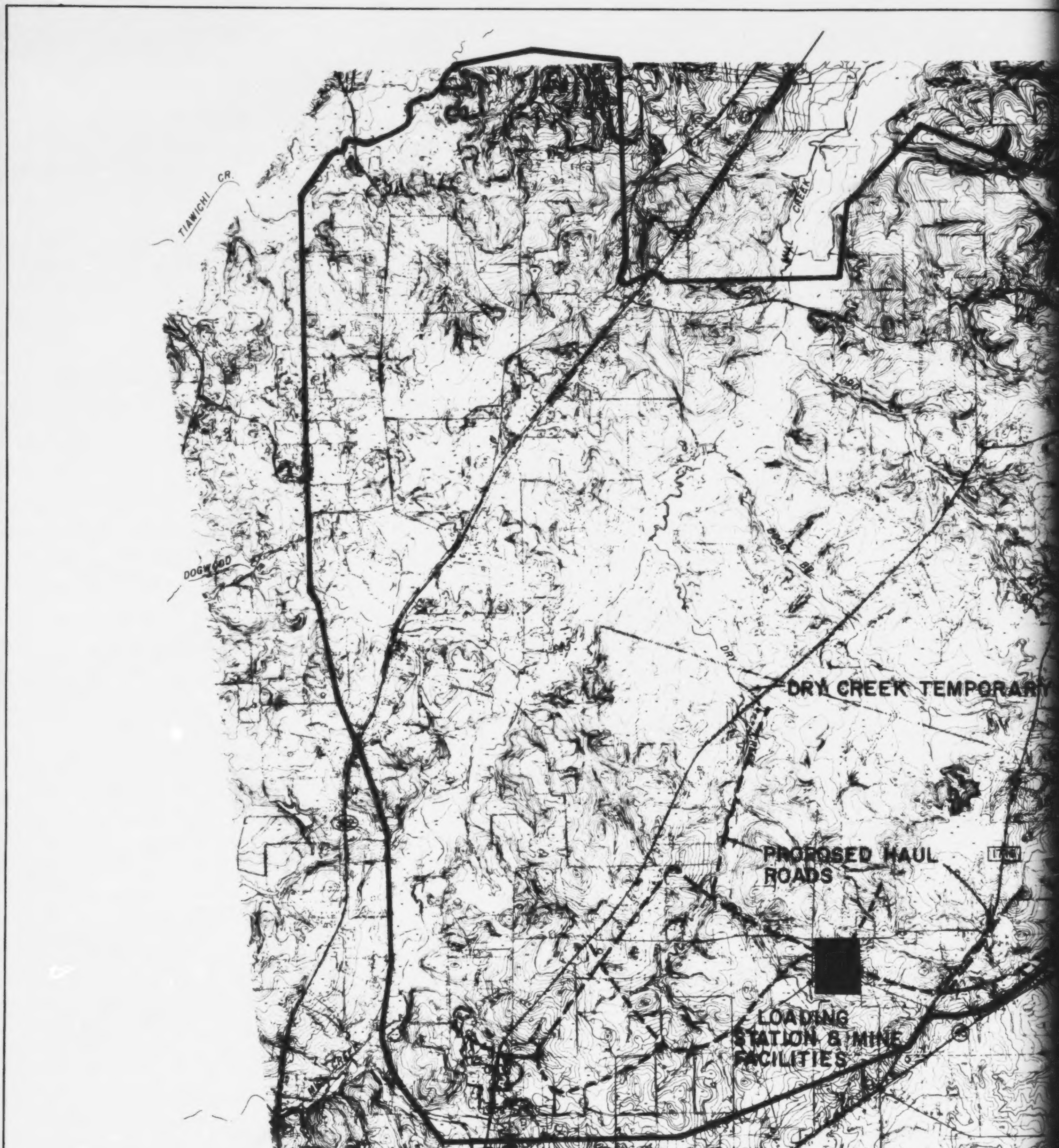
Ground-water seepage, as well as rainfall directly into the pits and surface- water runoff not intercepted by surface-water control facilities, would be primarily controlled by a series of collector and drainage ditches and sumps. Water would be pumped out of the pits to surface holding ponds for treatment. Additionally, several multi-well arrays for dewatering aquifers in the immediate vicinity of the active mine pit may be required at various sites throughout the project area. Dewatering wells would be moved incrementally to allow ground-water control during overburden and lignite removal and to restrict the areal and lineal extent of required dewatering facilities. Diesel pumps would be available for use as standby units and for use in areas where electric power would not be available.

Major streams in the project area are Tiawichi Creek and Mill Creek, which is a tributary of Tiawichi Creek. Tributary streams include Dry Creek, Boggy Branch, Todd Branch, Dogwood Creek, Adaway Creek and Beaver Run, all tributaries of Mill Creek. Several other tributary streams exist throughout the Martin Lake "D" Area mine. In general, the mining pits would be located away from the two major streams and stream diversions or rerouting are not anticipated. A 2,000-foot section of Dry Creek would be diverted during the first five years of mining. Diversions and rerouting of other small streams might be necessary to prevent streamflows from interferring with mining activities but are not presently planned. State and Federal permits for stream reroutings would be obtained when required. As required by the RRC's Surface Mine Regulatory Program, the combination of channel, bank and flood plain configurations would be designed to pass safely the peak runoff rate of a 10-year, 24-hour precipitation event for temporary diversions and a 100-year, 24-hour precipitation event for permanent diversions. The capacity of each diversion channel would be designed to equal or exceed the capacity of the unmodified stream channel.

Overburden removal, mining and reclamation operations would begin in May 1985, using the first 75-cubic-yard dragline. The second 75-cubic-yard dragline would begin in April 1987 and after 1987 the operations will be simultaneous. A third dragline would begin operations in 1994. Additionally, scrapers would be used where they can more efficiently move overburden, such as areas where draglines maneuverability is limited, to start or finish areas along subcrops or mining boundaries and for isolated shallow deposits. Scrapers also would be used for benching ahead of draglines in areas where overburden depth exceeds 100 feet. Drilling and blasting would not be required in either overburden removal or lignite mining. Stripping panels would be 120 feet wide and range in length from 3,000 to 10,000 feet. Overburden depths would range from 10 to 150 feet and the single lignite seam selected for mining averages 7 feet in thickness. Operations would start in areas with shallow overburden and progress into areas where overburden depths are greater.

Lignite would be extracted using either a backhoe or electric shovel and loaded into 100-ton bottom dump trucks. Mine floor conditions would dictate appropriate loading techniques. Bottom dump trucks would haul lignite along a system of haul roads (Fig. 5-4) from the mine pit to the railroad loading station where it would be run through the primary crusher, fed by conveyor to the silo, and then fed into the open gondola cars. The locomotive would be electric-powered from an overhead catenary system. The train would haul the lignite 11.5 miles to the MLSES (see Fig. 5-5 for the railroad location and Fig. 5-6 for a diagrammatic sketch of the loading operation).

All haul roads and access roads would be designed according to their respective uses. Existing roads that must be relocated or upgraded due to mining would be engineered according to state and Federal specifications, and be approved by the required local, state


TIAWICHI CR.
CREEK
DOGWOOD CR.
DRY
DRY CREEK TEMPORARY
PROPOSED HAUL ROADS
LOADING STATION & MINE FACILITIES

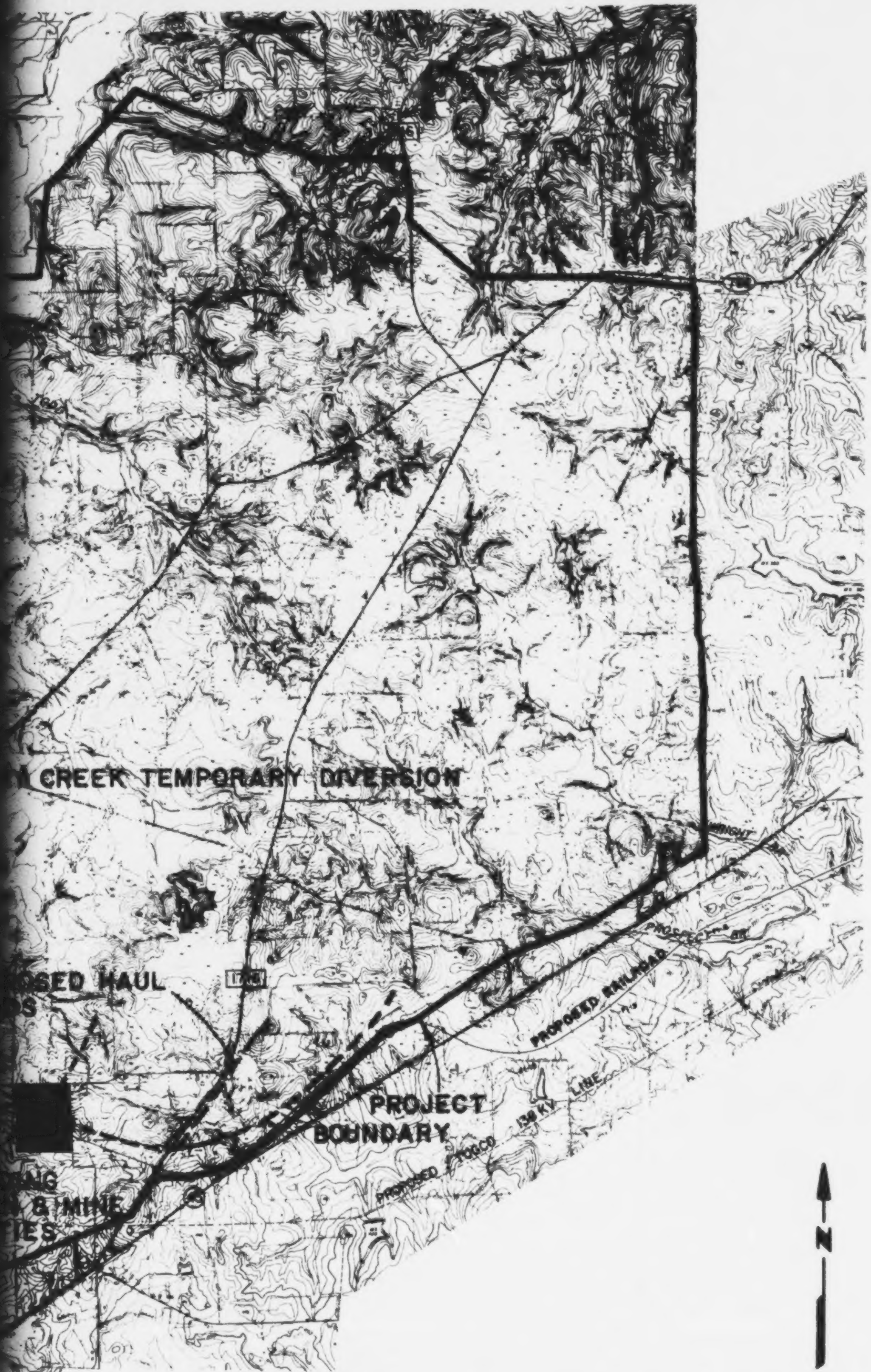


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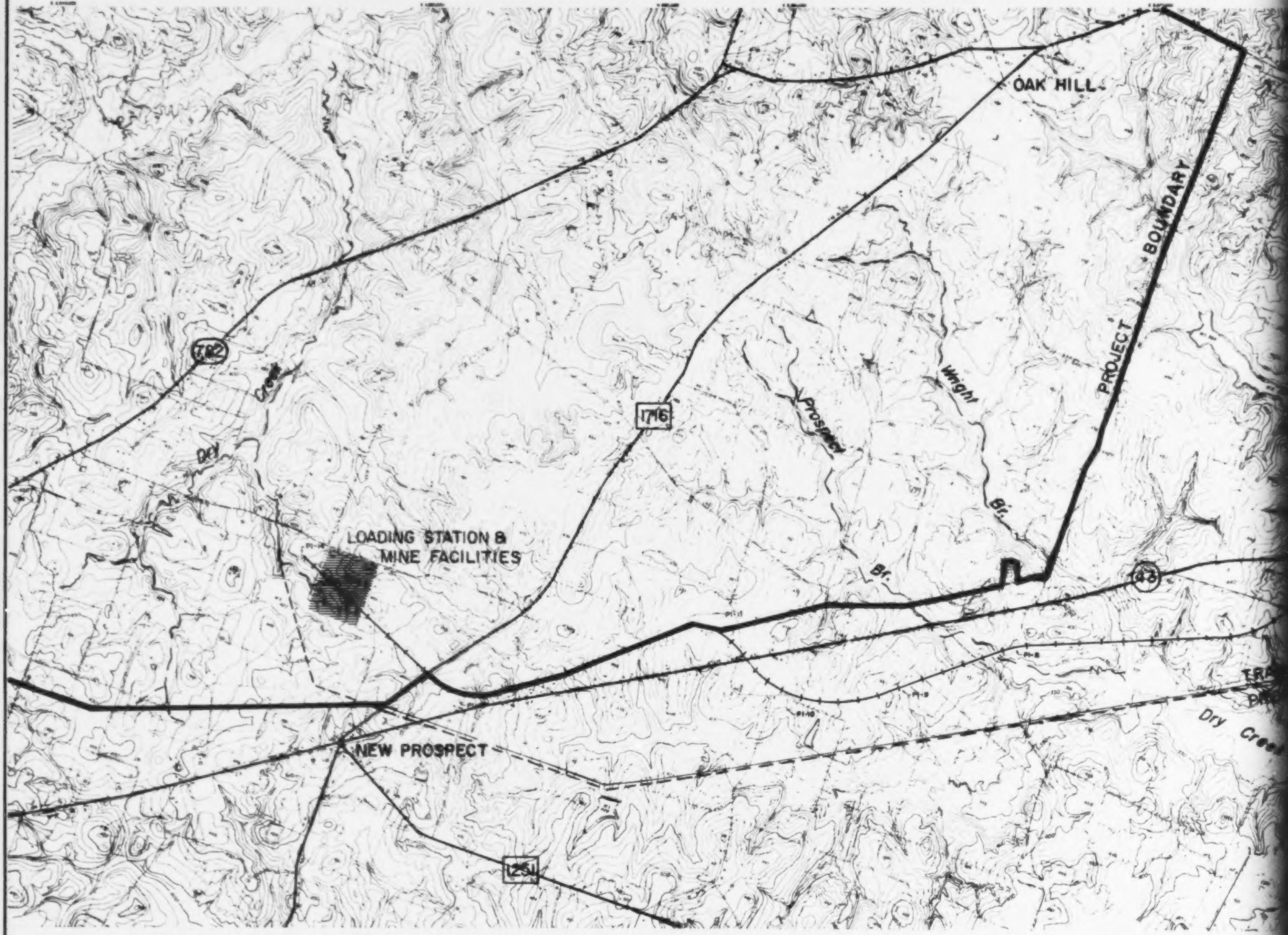
Fig. 5-4

PROPOSED HAUL ROADS


OAK HILL
PROJECT BOUNDARY
782
Dry Creek
1716
Prospect Br.
Wright Br.
LOADING STATION & MINE FACILITIES
43
NEW PROSPECT
1251
TRA
PRO
Dry Cree

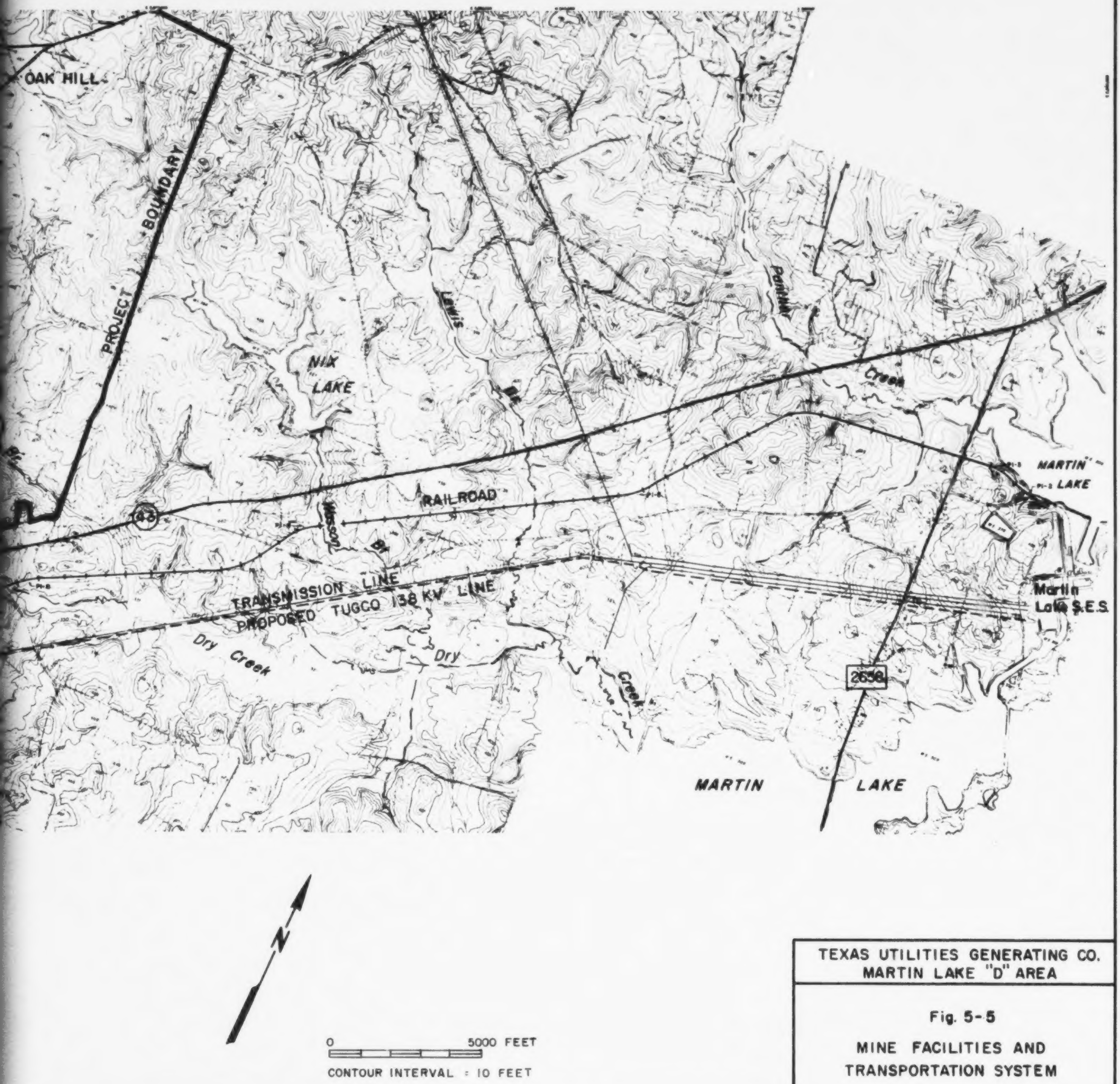


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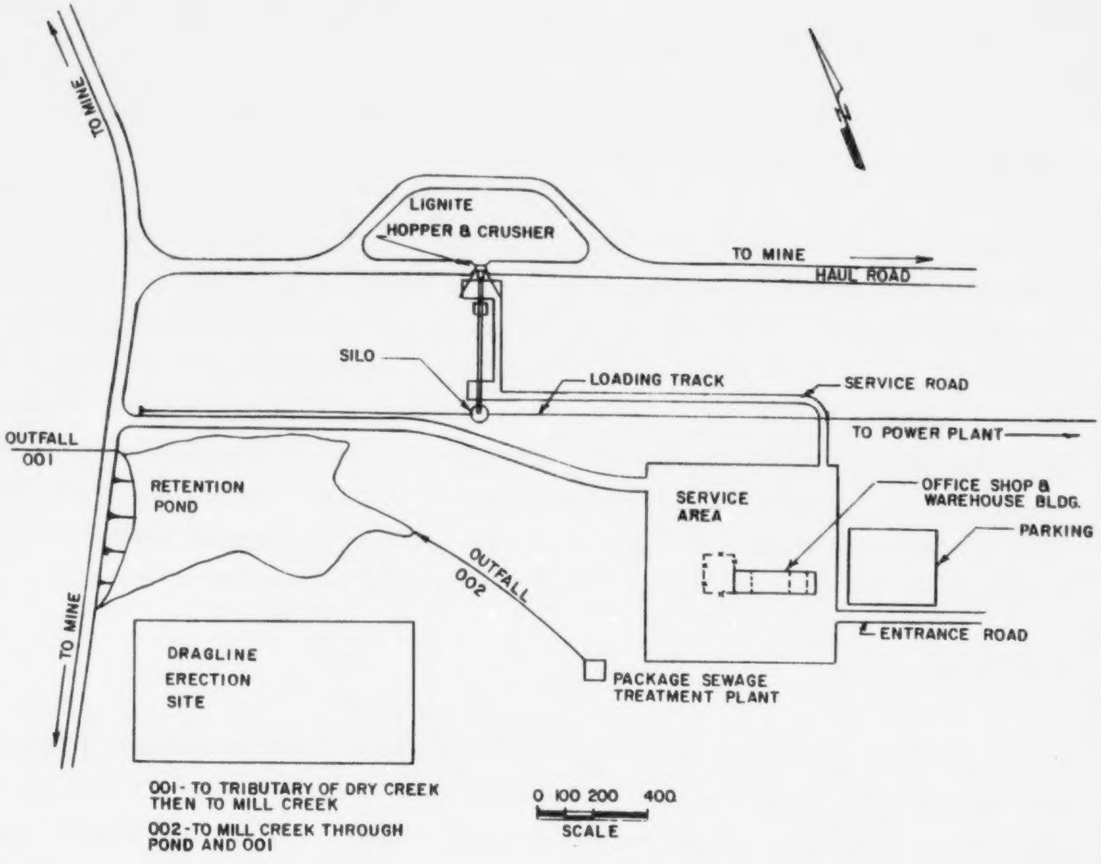
Fig. 5-5

MINE FACILITIES AND
TRANSPORTATION SYSTEM



Texas Utilities Generating Co.
Martin Lake "D" Area

Fig. 5-6

LOADING STATION
OPERATION

and Federal authorities prior to construction. Roads requiring relocation during the first five-year period would receive asphalt surface treatment. These are:

(1) FM 782 (portion to be relocated during the period 1985 to 1989);
(2) FM 1716 (portion to be relocated during the period 1985 to 1989);
(3) Unnumbered access road to Mt. Vernon Cemetery; and
(4) Others (unknown at this time).

Sections of several county roads would be closed at various times during the life of the project if approved by the County Commissioners.

Mine service facilities would be located near the loading station and would include an office, shop and warehouse building; parking area; service area; sewage treatment plant; retention pond; fuel storage facilities; dragline erection site; and other necessary facilities (Fig. 5-6). The construction and equipment erection phase at the mine would begin in early 1983 and end in early 1985. The initial work force would consist of approximately 12 construction workers. The construction work force is expected to peak during 1984 at approximately 145 employees and decline over the next two years. Operation and maintenance of the mine would begin in the second quarter of 1984. Staffing would continue to a peak of 240 employees in the second quarter of 1991.

5.2.3 Reclamation

The objective of reclamation is to return lands disturbed by surface mining activities to a land use condition which is as good as or better than that which preceded mining. The predominant premining land use for the proposed Martin Lake "D" Area lignite mine is agriculture. Equipment used for reclamation is primarily typical agricultural equipment with other specialized equipment used (contracted if necessary) as required. The thrust of the reclamation efforts would be to re-establish the existing use. This does not necessarily mean that the present vegetative cover would be re-established. Mining regulations allow for the approval of changing the vegetative cover type as long as the land use is re-established (see Sec. 6.11.3). A complete reclamation plan for the proposed surface mine area would include:

(1) Reconfiguration of the spoil to the approximate original contour;
(2) Preparation of the reconstructed soil;

(3) Establishment of a vigorous ground cover; and

(4) Proper management of vegetation following establishment.

Following mining, dozers would smooth out the spoil bank ridges. The final contour of the land would be similar to that of the surrounding, unmined terrain. Slopes on contoured areas would range from nearly level (0 to 1 percent) to moderately steep (10 to 16 percent). All cast overburden resulting from active mining would be graded as soon as practicable, generally within six months after disturbance (in accordance with RRC regulations). It should be noted, however, that prolonged rainfall periods could prevent grading of overburden within this six-month time period.

The applicant's preferred method for establishing a surface for plant growth would be the use of mixed spoil cast from a 75-cubic-yard dragline. Materials deemed undesirable because of physical or chemical properties (e.g., rocks or pyrites) for revegetation would be buried to depths greater than 48 inches from the surface. Lime would be used to control pH, and fertilizers would be used to enhance plant growth.

Current vegetative cover types are distributed evenly between pastureland and woodland with most of the woodland areas used for grazing. While other types exist on the project area, their acreages are of minor extent. Revegetation consistent with the major types will be discussed in the following sections.

Vegetation establishment would occur as close to active mining as practicable. These activities would commence within approximately 1,000 linear feet of mining operations and follow overburden removal by six months, weather permitting. Optimum planting schedules would be followed as closely as practicable. However, vegetation establishment would be a relatively continuous operation once mining commences. Weather conditions and optimum planting seasons may necessitate altering the proposed planting schedule. Establishment of a vegetative cover to reduce the potential for accelerated erosion is critical immediately after final grading. Since the potential for erosion exists at all times, both warm and cool season vegetation would be utilized.

Upland areas and slopes would be planted to pastureland and woodland. If soil preparation occurs at times other than the optimum planting dates for the desired species, a cover crop would be grown. Planting schedules and other information are shown on Table 5-1. Planting information for areas to be reforested is shown on Table 5-2. Bottomland areas would be planted to a mixture of hardwood seedling species (such as oaks and sweetgum) shown on Table 5-2. Subterranean clover would be one type of cover crop sown. This species withstands moist soil conditions better than other grasses and would provide effective erosion control in these areas. This cover crop would be grown during the first few years of woodland establishment.

Management/maintenance of all lands affected by the proposed mining activities would remain under TUGCO control until final bond release. TUGCO would be responsible for all management/maintenance activities. Pastureland would be managed to stimulate vegetative growth. Soil amendments would be applied as necessary, based on soil analyses, and pesticides would be applied as necessary to control weeds, insects and other pests. All pesticide application would be in accordance with manufacturer's label instructions and applicable local, state and Federal regulations. Cover crops and grasses would be managed to control undue competition between grasses and woody species and to ensure an adequate mulch. Establishment of a vegetative cover is necessary on other disturbed areas such as slopes, roadsides, dams and after pond removal. Special methods such as hydroseeding, mulching, etc., may be used. More detailed discussions of revegetation plans, including wildlife enhancement measures are provided in Secs. 6.2.3.5, 6.6.3.1 and 6.6.3.2.

5.3 ALTERNATIVES AVAILABLE TO EPA

Three alternatives available to EPA regarding its permit action are: (1) issue the NPDES permit as proposed; (2) issue the NPDES permit with certain conditions; or (3) deny the NPDES permit. The issuance of the NPDES permit as proposed would allow TUGCO to construct and operate the mining facilities as described in Sec. 5.2 and to discharge wastewater to the limits set forth in the permit. On October 13, 1982, EPA published final rules amending previously promulgated New Source Performance Standards (NSPS) for the coal mining industry. Under non-precipitation conditions, the prior effluent limitations are still in effect (Table 5-3). Discharges affected by precipitation events have been amended (Table 5-3). EPA may determine that special conditions should be added to the NPDES permit where necessary to minimize or avoid adverse environmental impacts. EPA may deny the NPDES permit if certain environmental factors are significantly adversely impacted and mitigation measures are unacceptable. These factors include violations of water quality standards, significant impacts on air quality, wildlife, endangered species, cultural resources, wetlands, flood plains and prime farm-

TABLE 5-3

NSPS EFFLUENT LIMITATIONS

Parameter	Maximum for any Day (mg/l)	Average of Daily Values for 30 Consecutive Days (mg/l)
Non-Precipitation Conditions		
Iron, total	6.0	3.0
Manganese, total	4.0	2.0
Total Suspended Solids	70.0	35.0
pH[1]	--	--
Precipitation Event Less Than the 10-year, 24-hour Event		
Settleable Solids	0.5[2]	--
pH	--	--
Precipitation Event Greater Than the 10-year, 24-hour Event		
pH	--	--

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[1] Within the range of 6.0 to 9.0 at all times.

[2] ml/l.

Source: Federal Register, Vol. 47, October 13, 1982.

lands. Denial of the NPDES permit by EPA could cause TUGCO to pursue the no action alternative and obtain the required fuel from another locality.

5.4 ALTERNATIVES AVAILABLE TO OTHER AGENCIES

The U. S. Army Corps of Engineers (COE) regulates the discharge of dredged and fill material into waters of the United States including adjacent wetlands under Section 404 of the Clean Water Act. Most such discharges of this project are expected upstream of the designated headwaters, and the work may be authorized by a general permit issued on a nationwide basis, provided the evaluation under the Section 404(b)(1) guidelines (defined in 40 CFR 230) does not cause significant concern for the aquatic environment and the project is in compliance with the following:

(1) that the discharge will not destroy a threatened or endangered species as identified under the Endangered Species Act, or endanger the critical habitat of such species;

(2) that the discharge will consist of suitable material free from toxic pollutants in other than trace quantities;

(3) that the fill created by the discharge of material will be properly maintained to prevent erosion and other non-point sources of pollution; and

(4) that the discharges will not occur in a component of a State Wild and Scenic River System.

Should work affecting streams or wetlands not comply with the above conditions or if the 404(b)(1) evlauation (Appendix B) shows significant, adverse impacts to the aquatic environment, the District Engineer may invoke discretionary authority and require an individual permit. An individual permit is required for any work that may be done below designated headwaters.

The Texas Air Control Board (TACB) requires a construction permit be applied for and received prior to start of construction and an operating permit be applied for within 30 days after the first day of operation to determine if air quality standards are being met.

The Railroad Commission of Texas (RRC) requires that detailed mining plans and specifications for the first five-year permit area be reviewed and a permit be obtained before any construction begins on the mine project site.

The Texas Department of Water Resources (TDWR) would require a Water Quality Waste Control Order for the project.

Should any of these permits be denied, the proposed project schedule would be extended and appropriate modifications or clarification of plans made.

6.0 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES

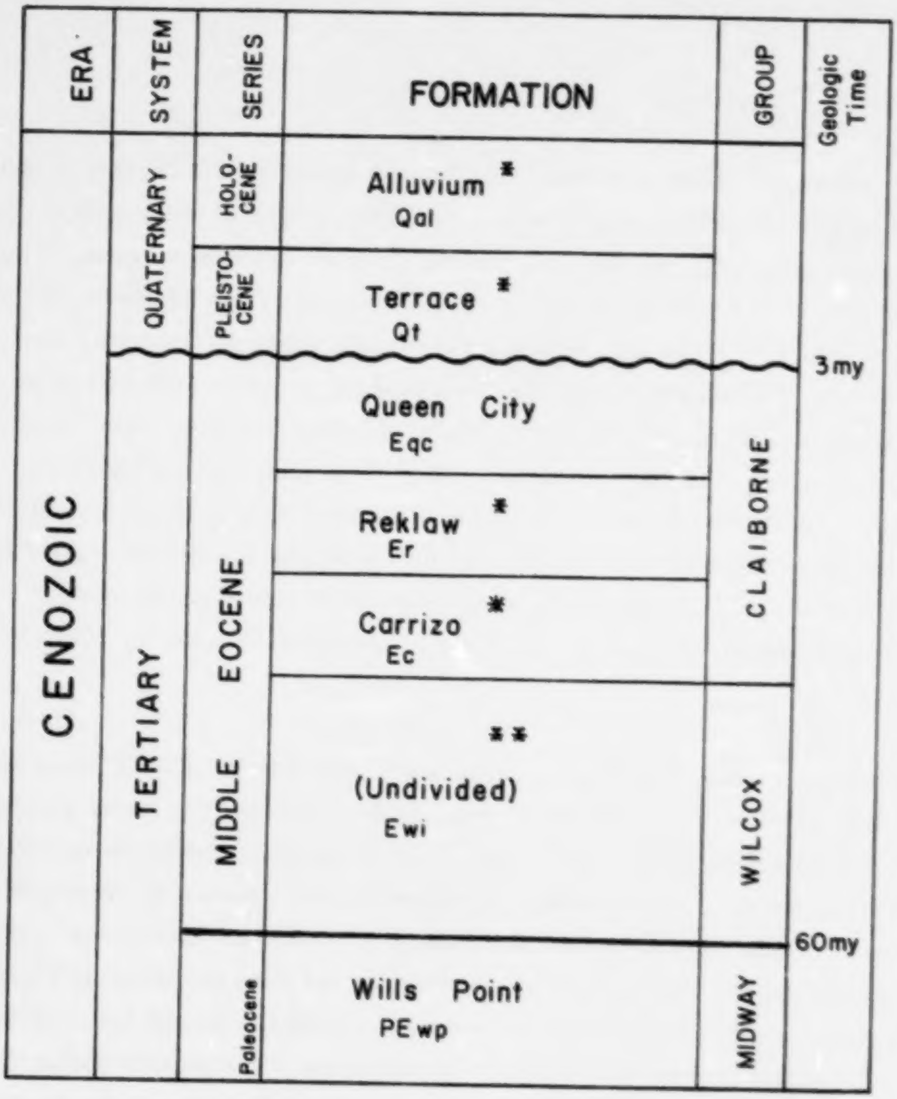
6.1 GEOLOGY AND TOPOGRAPHY

6.1.1 Existing Environment

The project area is located in the West Gulf Coast Plain section of the Gulf Coastal Plain physiographic province (Fenneman, 1938). Surface topography of the region is characterized by gently rolling hills that are dissected by dendritic drainage systems. Structurally, the proposed mine site is situated on the extreme western flank of the Sabine Uplift, a major domal structure affecting northeast Texas and northwest Louisiana. Also, the axis of the East Texas Embayment, a northeast-southwest trending, synclinal structure, passes about 35 miles northwest of the site. Both of these features have influenced the unconsolidated sedimentary strata that underlie the project area by altering the gentle, gulfward dip found across most of the region. In general, the geologic formations in the site vicinity dip to the northwest at about 16 feet per mile (0.2 degree). Data from test holes drilled in the project area indicate no evidence of faulting, and seismic activity is very infrequent and of minimal intensity (U. S. Dept. of Commerce, 1970; Von Hake, 1977).

The stratigraphic section (Fig. 6-1) to be mined in the Martin Lake "D" Area consists of the following geologic units: (1) recent alluvial deposits; (2) the lower portion of the Eocene Reklaw Formation; (3) the Eocene Carrizo Formation; and (4) the undifferentiated Eocene Wilcox Group. Lithologically, the sediments are composed of varying proportions of siliceous clay, silt, sand and gravel and lignite. The surface distribution of the units in the mining area and the location of five overburden core sites are shown in Fig. 6-2. The surface distribution of units between the mining area and the MLSES (i.e., the location of the railroad and transmission line) reflect a continuation of the pattern shown in Fig. 6-2. Recent alluvial deposits are present along the bed of Dry Creek and several of its tributaries. The Reklaw Formation is present in only isolated patches and the Carrizo is located primarily near the area of New Prospect. The majority of the area is part of the Wilcox outcrop shown in the southeastern corner of the mining area.

Over 4,000 drill holes have been completed in a grid system over the project to determine the extent and thickness of lignite and overlying sand and clay layers. Drillers noted the



ERA	SYSTEM	SERIES	FORMATION	GROUP	Geologic Time
CENOZOIC	QUATERNARY	HOLOCENE	Alluvium * Qal		
		PLEISTOCENE	Terrace * Qt		3my
	TERTIARY	MIDDLE EOCENE	Queen City Eqc	CLAIBORNE	
			Reklaw * Er		
			Carrizo * Ec		
			** (Undivided) Ewi	WILCOX	60my
		Paleocene	Wills Point PEwp	MIDWAY	

Geologic time in millions of years (my)

* Stratigraphic units involved

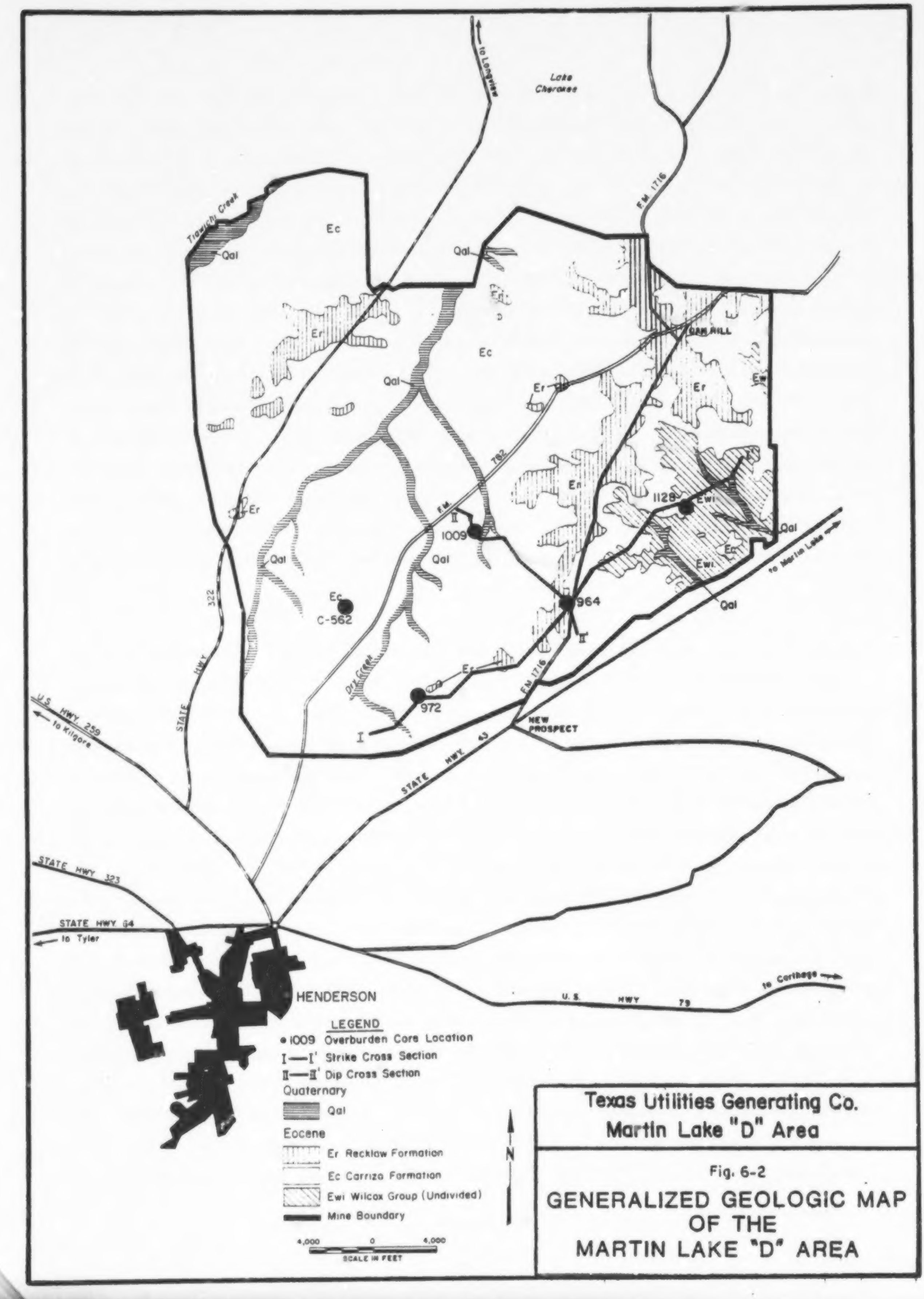
** Lignite bearing unit

~ Unconformable contacts

Texas Utilities Generating Co.
Martin Lake "D" Area

Fig. 6-1

Stratigraphic Column for the Project Region

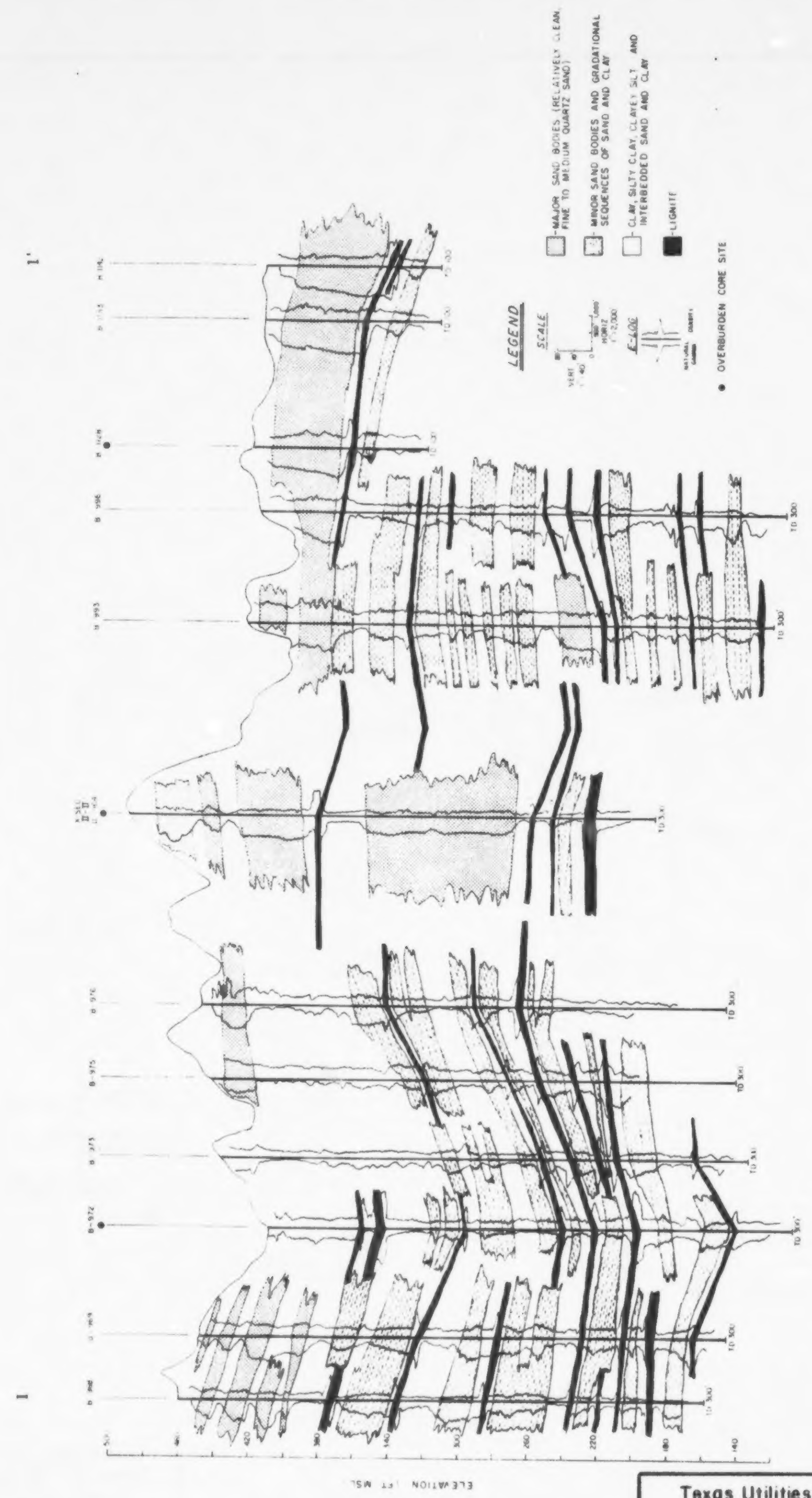


Texas Utilities Generating Co.
Martin Lake "D" Area

Fig. 6-2

GENERALIZED GEOLOGIC MAP OF THE MARTIN LAKE "D" AREA depth, thickness and physical characteristics of each layer encountered. Electric logs measuring the density, natural gamma and resistivity of subsurface layers have been run on approximately 50 percent of the drill holes to provide additional information and precision to the drillers logs data. Data collected from drill holes and electric logs were used to develop geologic cross-sections of the first five-year mine area (Figs. 6-3 and 6-4) in the south and southwestern section of the project area. After review of the cross-sections and consultation with the RRC, five sites were selected by TUGCO to collect core samples for detailed chemical and physical analysis. The sites were chosen to be representative of the different combinations of sediment and depositional environmental types that would be excavated and reclaimed during mining operations in the first five-year mine area. These core holes were spaced evenly over approximately the southern half of the project area. The data do not characterize exactly the overburden throughout the project but strata in other portions of the mining area consist of sediments deposited under basically similar conditions and are expected to exhibit similar physical and chemical properties. Tests run on core samples included cation exchange capacity, chemical composition, acid-base accounting, trace elements and texture analysis (Appendix D).

The lignite to be mined lies within the upper part of the Wilcox Group ranging from 10 feet to 150 feet below land surface (Figs. 6-3 and 6-4). According to Fisher and McGowen (1967), Wilcox sediments were deposited as part of a fluvial depositional environment called the Mt. Pleasant Fluvial System. In early Eocene time, large streams meandered over a relatively flat coastal plain that is now northeast Texas. As these streams migrated and changed their course of flow, they deposited fine-grained silts and clays in large areas between different stream channels. These interchannel areas were lowland swamps and marshes that supported abundant vegetation. Over time, this vegetation formed large peat deposits that eventually became the lignites found in the Wilcox today. The depositional process was repeated many times and resulted in numerous layers of lignite. Some layers are relatively thick (greater than 3 feet) and occur over a large area while others are much thinner and more discontinuous (lignite stringers). Physical and chemical characteristics of the lignite to be mined at the "D" Area (Appendix E) compare favorably with the characteristics of lignite presently mined at areas "A," "B" and "C" (data provided by TUGCO, November 1982). Differences exist but the parameters measured fall within the same general range (e.g., average ash content, "D" = 6.87 percent and "A," "B," "C" = 8.28 percent; average sulfur content, "D" = 1.36 percent and "A," "B," "C" = 0.94 percent). The potential impacts associated with


EAST - WEST STRIKE CROSS - SECTION
I
I'
B-972
B-975
B-976
B-993
B-998
TD 300'
ELEVATION (FT MSL)
500
460
420
380
340
300
260
220
180
140
LEGEND
SCALE
VERT 1"=40'
HORIZ 1"=2,000'
E-LOG
NATURAL GAMMA
MAJOR SAND BODIES (RELATIVELY CLEAN, FINE TO MEDIUM QUARTZ SAND)
MINOR SAND BODIES AND GRADATIONAL SEQUENCES OF SAND AND CLAY
CLAY, SILTY CLAY, CLAYEY SILT AND INTERBEDDED SAND AND CLAY
LIGNITE
● OVERBURDEN CORE SITE

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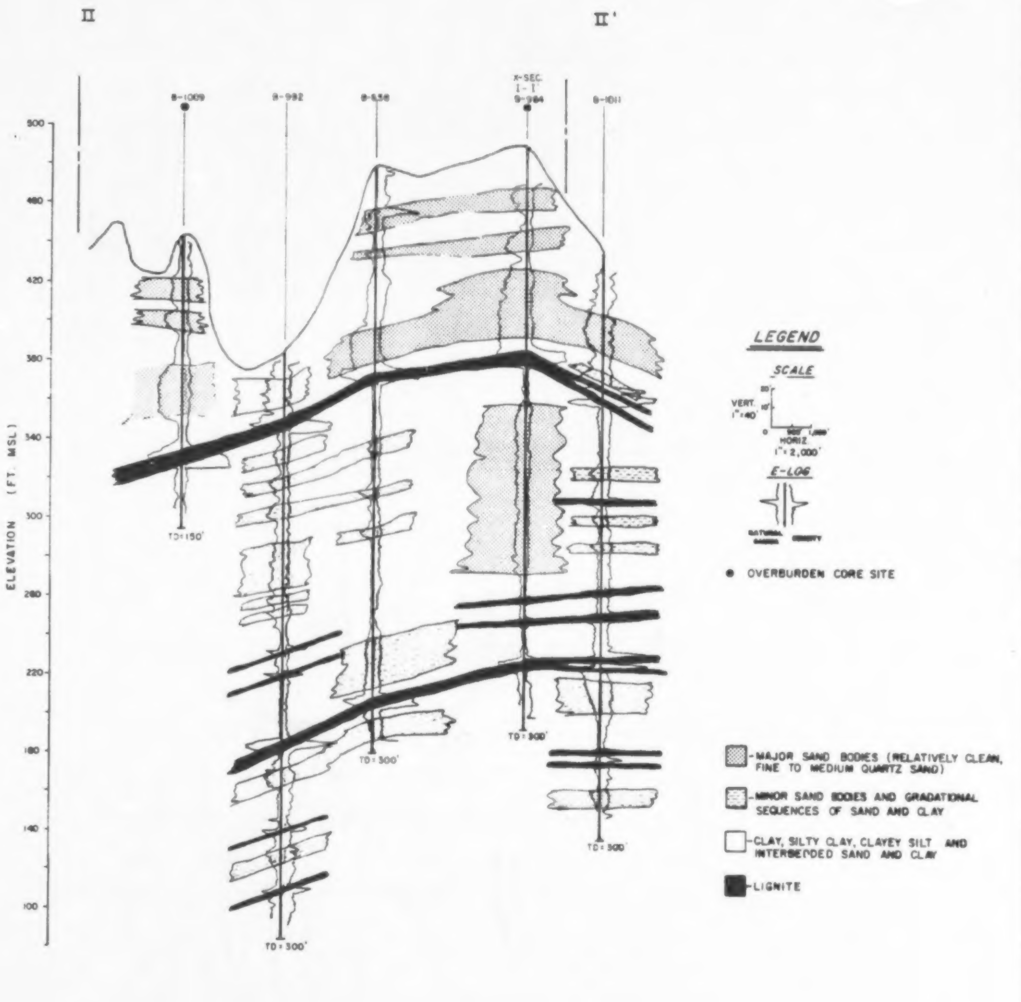
Martin Lake "D" Area

Fig. 6-3
EAST-WEST STRIKE
CROSS SECTION OF PROJECT AREA

NORTH SOUTH DIP SECTION



Texas Utilities Generating Co.
Martin Lake "D" Area

Fig. 6-4
NORTH - SOUTH DIP
CROSS SECTION OF PROJECT AREA

these characteristics are addressed in Sec. 6.10.3.1. Concentrations of radioactive elements and metals present in "D" Area lignite (Appendix E) are within the ranges normally found in soil (Gough et al., 1979).

The Wilcox is over 500 feet thick in the project area and represents several million years of sediment accumulation. During that time span, the dynamic processes of the fluvial environment deposited the vertically and horizontally discontinuous, heterogenous sediments that comprise the Wilcox. In the project area, the Wilcox above the target lignite seam is mostly gray, fine-grained, quartz sand and sandy clay (Appendix D). The formation outcrops only in the southeastern part of the site.

The Carrizo Formation overlies the Wilcox Group and is divided into lithologically different upper and lower parts. The lower section is homogenous, light brownish gray, fine-grained, quartz sand with occasional gravels at the base. The upper section is also predominantly sand, but it contains gray, carbonaceous silt, silty clay, and clay. The Carrizo outcrops over most of the project area, and its thickness is typically 10 to 20 feet. The Reklaw Formation overlies the Carrizo, but its occurrence is limited to erosional remnants capping higher elevations found primarily along Texas FM 1716, in the eastern part of the site, and along Texas Hwy 322, in the northwestern part of the site. Because of erosion, only the lower part of the formation (approximately 15 feet) is present. This lower unit consists of grayish green, fine- to very fine-grained, glauconitic and clayey, quartz sand. Iron contained in the Reklaw has ferruginously cemented some of the sands and formed indurated bedding in parts of the unit. Alluvial deposits are found along the beds of several streams that drain the project area. The deposits are thin, have limited extent, and consist of clay, silt, sand and some gravel.

6.1.2 Impacts of No Action Alternative

If no action is taken to develop the Martin Lake "D" Area mine, it is anticipated that the site would remain rural and agriculturally oriented. Under this alternative, extraction of common construction materials (sand, clay and gravel), oil and natural gas would continue in response to demand and recovery economics.

6.1.3 Impacts of Project Alternatives

6.1.3.1 Geology. Mining would disrupt the bedded geologic strata within the mine area creating an irreversible, adverse impact. Strata would be permanently altered.

There would be localized areas of different percentages of sand, silt and clay and the subsurface would be a mass of fragmented material of varying composition.

6.1.3.2 Topography. Post-mine topography would not interfere with land use practices that are currently found in the area, therefore, only short-term adverse impacts would be expected. Overburden removal would alter the existing topography at the project site and would be the most visually obvious impact of mining. Additional modifications to the land surface would be associated with haul roads, sedimentation structures, and construction activities at the site. Grading and other reclamation measures would largely reduce topographic changes by approximating the original land surface configuration (see Fig. 5-3). TUGCO would annually check the approximation of original contours by the use of photo-correlation with premine topographic maps as it does at other mine sites. Return to nearly original contours is aided by the mining methods proposed. Placing spoil in the adjacent pit ensures that, for example, when a hill is mined through all the spoil is placed only one pit-width away and thus a "new" hill is formed. Major areas of textural dissimilarities would not exist in the subsurface of the replaced spoil and subsidence or slumping would not be significant. Spoil commonly undergoes an initial bulking, or volumetric increase, immediately followed by redensification and settling. Schneider (1977) found that maximum initial bulking ranged from 24 to 45 percent. The initial bulking is immediately followed by redensification of the spoil with about 75 percent of the settling occurring within the first year after spoil placement (Schneider, 1977; Rangel, 1979). The final increase or decrease in volume is dependent upon time, thickness of overburden mined and the relative percentage of silt, clay and sand. It is expected that, at Martin Lake Area "D", an approximate 10 percent net volume increase would result after the initial bulking and redensification occur. The net volume increase would serve to replace the volume of lignite removed with a small excess.

6.1.3.3 Sensitive and Unique Geologic Conditions. No geologic hazards or unique geologic features, such as paleontological sites or stratigraphic type localities, have been identified in the project area or are suspected to exist.

6.1.3.4 Economic Deposits. At present, there are several small, locally owned and operated clay and gravel pits in the project area. Lignite mining would irretrievably remove these deposits from production. Because clay and gravel of equal quality are available over much of east Texas and the deposits in the project area are limited in size, lignite mining would not adversely impact this segment of the regional mineral economy.

Clay pits in the southwest part of the mine site adjacent to Texas FM 782 are owned and intermittently operated by Henderson Clay Products. Lignite mining is expected to avoid these pits since they are located outside of the mine blocks shown on Fig. 5-3.

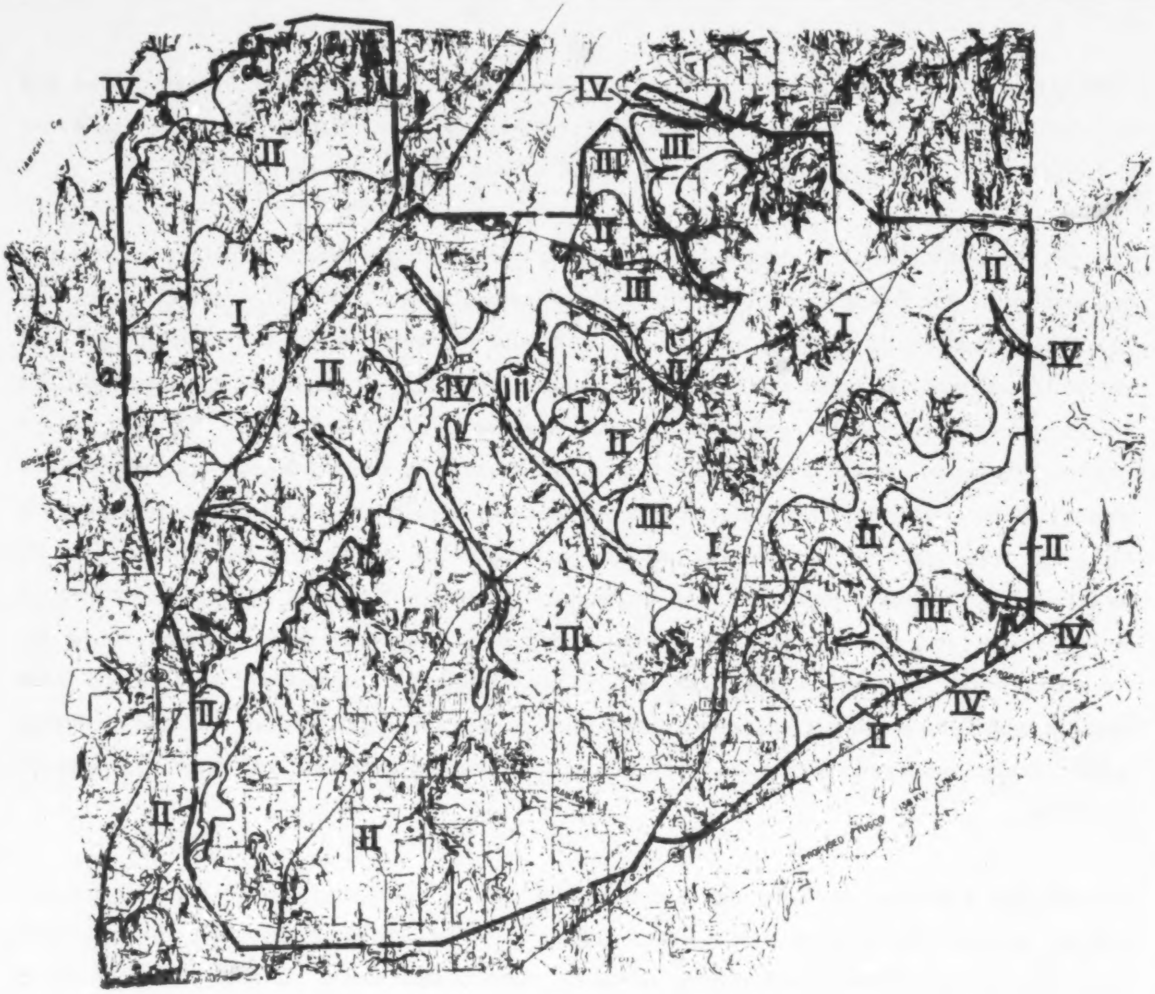
The proposed mine area is situated among several oil and gas fields, and exploration and production of these resources are expected to remain active. With the exception of one gas well completed in 1941 at a depth of 1,283 feet below ground surface, all oil, gas and saltwater disposal wells in the project and adjacent area are completed, or are projected for completion, at depths greater than 7,000 feet below ground surface. TUGCO policy concerning producing oil and gas wells in mining areas is to coordinate operations with owners of the facilities. Coordination is designed to achieve the following objectives: (1) Minimize the impacts on existing oil and gas facilities to the extent practicable by avoiding facilities or delaying effects on the facilities until the most appropriate time; (2) Relocate oil and gas pipelines to assure continued production from existing wells; (3) Coordinate the location and scheduling of new wells to minimize interference with current and future mining operations; and (4) To negotiate agreements for compensation with affected owners in instances when conflict between production and mining cannot be avoided.

Oil and gas pipelines crossing the mine area would be relocated by the pipeline owners during mining. Relocation would occur sequentially as mining progresses and pipelines would be moved either to non-mining areas or to reclaimed areas. Should any spills occur during relocation, the pipeline owners would be responsible for cleaning up the spill in a timely fashion. There should be no significant adverse impacts to ground water resulting from any spills. Since the volume of any spill would be very small, the spill would be localized and it would be cleaned up quickly. Cleanup procedures would include the use of earthen berms for spills on land, floating barriers for spills in water and the use of vacuum systems or absorbent material for removal. Contaminated soil would be disposed of in a land fill. Potential impacts to wetlands and flood plains are discussed in Sec. 6.5.3.

6.2 SOILS AND PRIME FARMLAND

6.2.1 Existing Environment

There are 21 soil map units within the project area, which were placed into five major groups, within which the soils have fairly similar properties. Figure 6-5 illustrates the



MAP SYMBOL	SOIL GROUP NAME
I	Loamy Upland Soils of the (lower) Reklaw Formation — Nacogdoches, Trawick, Alto
II	Loamy Upland Soils of the (upper) Carrizo Sand Formation — Kirvin, Cuthbert, Bowie
III	Sandy Upland Soils of the (lower) Carrizo Sand Formation — Betis, Lilbert, Tenaha
IV	Loamy Terrace and Bottomland Soils — Bernaldo, Nahatche, Mantachie, and Iuka

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MARTIN LAKE "D" AREA

Fig 6- 5

GENERAL SOILS MAP

principal locations of each group (Group V is omitted from this figure because of small acreage and very scattered locations). Soil map units within each of the five groups are listed in Table 6-1. This table also shows the acreages of each map unit component and designates whether or not it is a prime farmland soil. Figure 6-6 is a detailed map showing the location of each map unit and the distribution of prime farmland soils within the mining area. The soils in the railroad and transmission line corridors (273 and 114 acres, respectively) are not graphically shown but consist primarily of Kirvin, Bowie and Cuthbert soils in associations with other soils of lesser importance. Prime farmland soils comprise about 33.5 percent of the project area and about 34.3 percent of the mine block area (Fig. 1-2). They are distributed fairly uniformly throughout the area. Table 6-1 shows factors that exclude the remaining soils from prime farmland classification. A discussion of the major soil groups listed in Table 6-1 is given in the following sections. Groups I, II, III, IV and V have been used to conveniently discuss several soil map units together because of similar characteristics.

6.2.1.1 Group I - Upland Soils of the "Redlands" Areas. The soils of this group occur, for the most part, on broad, gently sloping to sloping ridges. Locally, they are commonly referred to as "Redland" soils because most of them are dark red in color. The parent material in which they developed is dominated by greensand marl associated with the Reklaw geological formation. The major soils within this group (Trawick and Nacogdoches) have a dark red fine sandy loam surface layer about six inches thick underlain by a dark red clayey subsoil to depths of 20 to 70 inches. Usually the underlying material is partially weathered greensand. The Alto and Percilla map units typically occur in small shallow depressions and are slightly wetter than the other soils. A large part of the Trawick soils (Unit 20) has a gravelly surface.

Typically, the soils of this group are medium acid (pH 5.6-6.0) in the surface and strongly acid (pH 5.1-5.5) in the subsoil. They range from well drained on convex slopes to poorly drained in depressed areas. Natural fertility is generally low, and lime and fertilizer are required for good yields. They are productive with good management practices. The Percilla soils have a seasonal high water table, and gravelly phases of the Trawick soils are limited by the gravel content and steep slopes. Sloping areas of the Nacogdoches and Trawick soils are subject to erosion, where vegetative cover is sparse or absent.

TABLE 6-1

SOILS OF THE MARTIN LAKE "D" AREA

(Source: EH&A, 1981b)

	Map Unit Components		Total Project Area		Within Mine Blocks		Prime Farmland Soils[3]	
Soil Groups	Map Symbol[1]	Name	Acres	Percent[2]	Acres	Percent[2]	Yes/No	Excluding Limitations[4]
I - Upland soils of the "Redlands" areas	1	Alto Variant fine sandy loam, 1-5% slopes	303	1.2	287	1.6	Yes	-
	14	Nacogdoches fine sandy loam, 1-5% slopes	327	1.3	313	1.7	Yes	-
	16	Percilla loam, 0-1% slopes	50	0.2	50	0.3	No	Wetness
	19	Trawick fine sandy loam, 1-5% slopes	2,334	9.4	2,068	11.5	Yes	-
	20	Trawick gravelly fine sandy loam, 5-20% slopes	2,181	8.7	1,796	10.0	No	Erosive, gravelly
II - Other upland soils with thin sandy surfaces and clayey or loamy subsoils	3	Bernaldo fine sandy loam, 1-5% slopes	97	0.4	19	0.1	Yes	-
	4	Bernaldo - Besner complex	92	0.4	15	0.1	Yes	-
	6	Bowie fine sandy loam, 1-5% slopes	3,431	13.7	2,443	13.6	Yes	-
	7	Cuthbert fine sandy loam, 5-30% slopes	4,980	20.0	3,612	20.2	No	Erosive
	9	Kirvin fine sandy loam, 1-8% slopes	2,756	11.0	2,028	11.3	No	Erosive
	12	Mollville loam, 0-1% slopes	348	1.4	258	1.4	No	Wetness
	13	Mollville - Besner complex	159	0.6	63	0.4	No	Wetness
	17	Ruston fine sandy loam, 1-5% slopes	120	0.5	87	0.5	Yes	-
III- Other upland soils with thick sandy surfaces	5	Betis loamy fine sand, 0-8% slopes	1,243	5.0	955	5.3	No	Droughty, erosive
	10	Lilbert loamy fine sand, 1-8% slopes	1,114	4.4	752	4.2	No	Droughty, erosive
	18	Tenaha loamy fine sand, 5-20% slopes	1,441	5.8	911	5.1	No	Droughty, erosive
IV- Soils on flood plains of local streams	2	Angelina Variant, frequently flooded	85	0.3	30	0.2	No	Wetness, frequent flooding
	8	Iuka fine sandy loam, occasionaly flooded	1,661	6.7	920	5.1	Yes	-
	11	Mantachie complex, frequently flooded	555	2.2	172	1.0	No	Frequent flooding
	15	Nahatche complex, frequently flooded	297	1.2	34	0.2	No	Frequent flooding
V - Miscellaneous land types	21	Pits	409	1.6	295	1.6	No	Soil Removed
		TOTAL SOILS	23,983	96.1	17,108	95.5		
		Water	129	0.5	74	0.4		
		Out Areas[5]	851	3.4	734	4.1		
		GRAND TOTAL	24,963		17,916			
		(Prime Farmland	8,365	33.5	6,152	34.3)		

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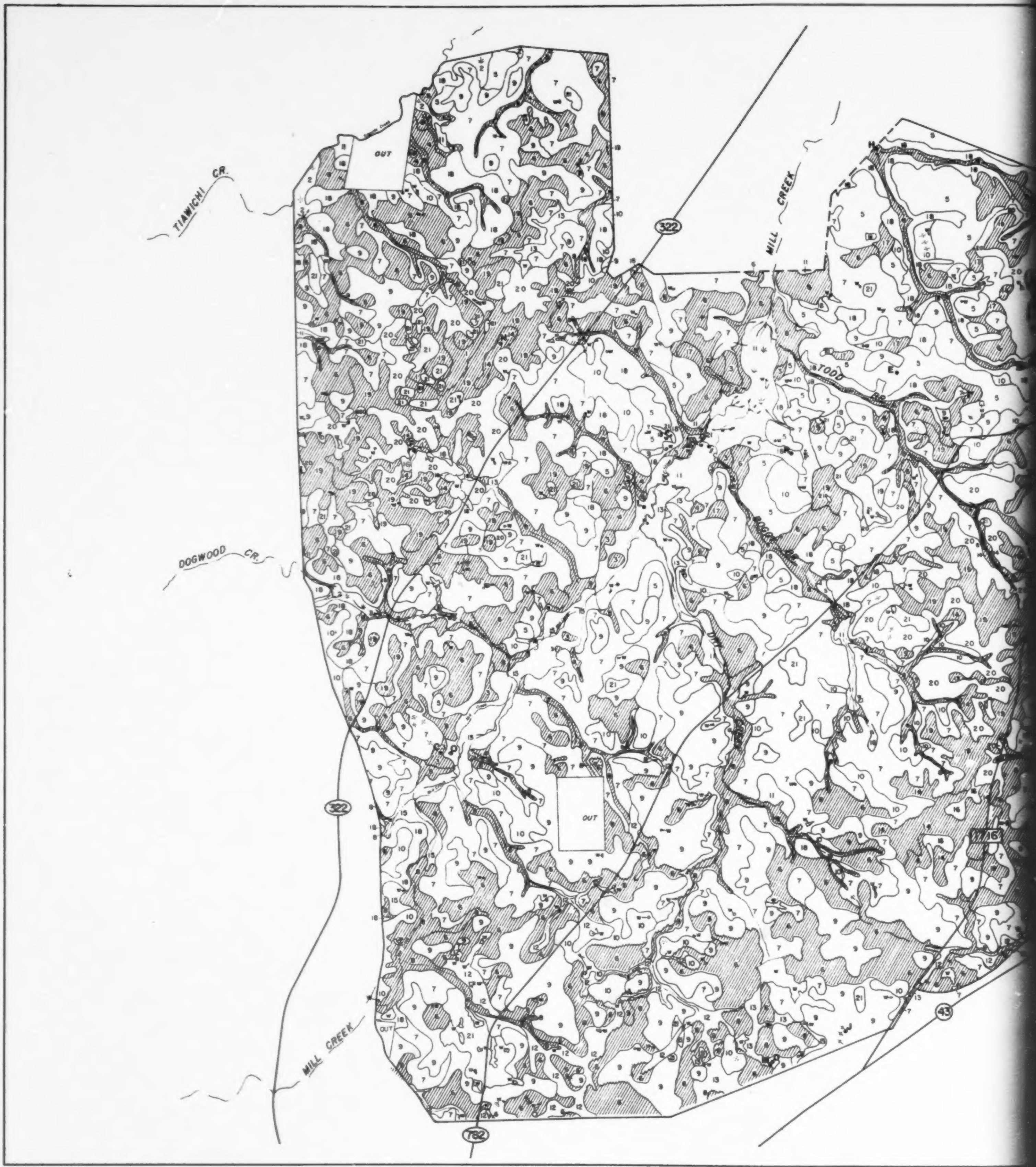
[1] Symbols that appear on map (Fig. 6-5).

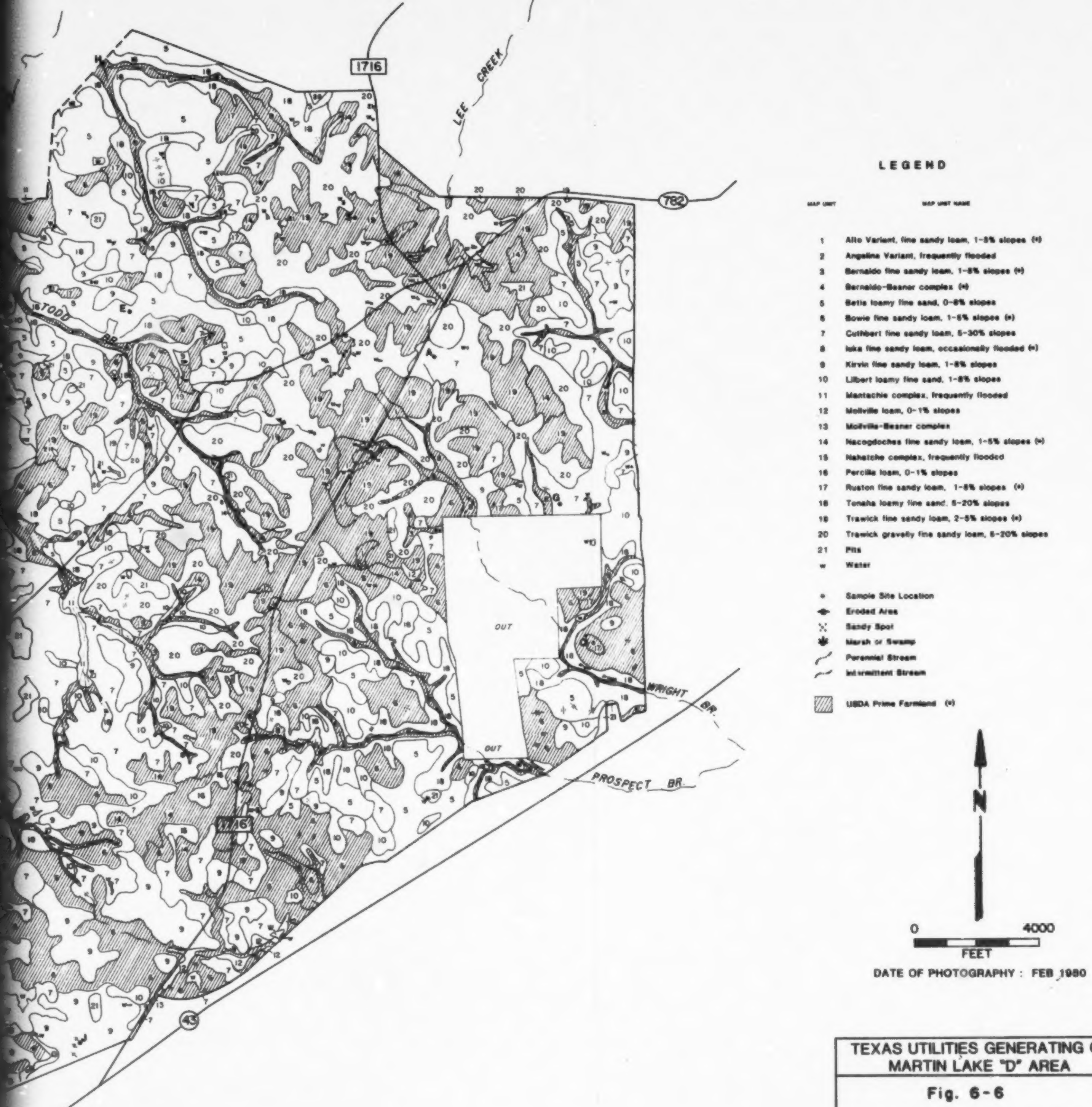
[2] Percent of entire study area of 24,963 acres or the entire mine block area of 17,916 acres.

[3] Prime farmland soils as defined in section 657.5(a), Federal Register, Vol. 43, No. 21, Tuesday, January 31, 1978. Commonly referred to as SCS-designated prime farmland soils.

[4] Primary limitations excluding from prime farmland soils; not all of the limitations affecting use and management are shown.

[5] Out areas are tracts of land that could not be surveyed because owners would not allow access.


TIAWICHI CR.
OUT
322
MILL CREEK
TODD
DOGWOOD CR.
BOGG
OUT
322
1716
43
MILL CREEK
OUT
782


LEGEND
MAP UNIT
MAP UNIT NAME
1 Alto Variant, fine sandy loam, 1-5% slopes (*)
2 Angelina Variant, frequently flooded
3 Bernaldo fine sandy loam, 1-5% slopes (*)
4 Bernaldo-Besner complex (*)
5 Betis loamy fine sand, 0-8% slopes
6 Bowie fine sandy loam, 1-5% slopes (*)
7 Cuthbert fine sandy loam, 5-30% slopes
8 Iuka fine sandy loam, occasionally flooded (*)
9 Kirvin fine sandy loam, 1-8% slopes
10 Lilbert loamy fine sand, 1-8% slopes
11 Mantachie complex, frequently flooded
12 Mollville loam, 0-1% slopes
13 Mollville-Besner complex
14 Nacogdoches fine sandy loam, 1-5% slopes (*)
15 Nahatche complex, frequently flooded
16 Percilla loam, 0-1% slopes
17 Ruston fine sandy loam, 1-8% slopes (*)
18 Tenaha loamy fine sand, 5-20% slopes
19 Trawick fine sandy loam, 2-5% slopes (*)
20 Trawick gravelly fine sandy loam, 5-20% slopes
21 Pits
w Water
Sample Site Location
Eroded Area
Sandy Spot
Marsh or Swamp
Perennial Stream
Intermittent Stream
USDA Prime Farmland (*)
N
0
4000
FEET
1716
782
43
LEE CREEK
TODD BR.
WRIGHT BR.
PROSPECT BR.
OUT
OUT

DATE OF PHOTOGRAPHY : FEB 1980

TEXAS UTILITIES GENERATING CO.
MARTIN LAKE "D" AREA

Fig. 6-6

DETAILED SOILS

6.2.1.2 Group II - Other Upland Soils with Thin Sandy Surfaces and Clayey or Loamy Subsoils. This is the largest group of soils within the project area, occupying about 48 percent of the project site. The majority of these soils developed in parent materials associated primarily with the upper part of the Carrizo Formation, which contains stratified shale and sandstone. Some areas may be associated with members of the Wilcox Group. A few soils in Group II developed on loamy terraces above the flood plains of local streams.

The Cuthbert and Kirvin soils occur on gently to steeply sloping convex ridges. They have fine sandy loam surfaces about 12 inches thick. Below this is a clayey subsoil extending to depths of about 40 inches in the Cuthbert soils and to about 50 to 60 inches in the Kirvin soils. Stratified sands and shales are in the lower part of the soil. These soils are well drained. They are acid and are low in natural fertility, thus requiring lime and fertilizer for most cultivated crops and pasture. Unless protected by vegetative cover, they are highly erosive on sloping areas.

The Bowie and Ruston soils have fine sandy loam surfaces about 10 to 15 inches thick over a thick, loamy subsoil. They are well drained and are acid throughout. Natural fertility is low and the soils require lime and fertilizer for good crop production. They respond well to good management practices but are subject to erosion, especially on steeper slopes.

The Bernaldo, Besner and Mollville soils are minor components within this group and are generally associated with terraces above the flood plains. Besner soils are on mounds and occur in a complex pattern with either the Bernaldo or Mollville soils in intermound positions. The Bernaldo and Besner soils have fine sandy loam surfaces and sandy clay loam or clay loam subsoils. They are well drained and are acid throughout. Natural fertility is low, and lime and fertilizer are required for satisfactory crop production. Mollville soils, in more depressed areas, are poorly drained. Typically, they have loam surfaces to a depth of about 14 inches and loam or clay loam subsoils. They are acid throughout and are low in natural fertility. They are poorly drained and have a high water table during wet seasons. They require drainage in addition to lime and fertilizer for a satisfactory crop production.

6.2.1.3 Group III - Other Upland Soils with Thick Sandy Surfaces. Soils within this group (Betis, Lilbert and Tenaha) developed primarily in parent materials associated with sandier members of the Carrizo Formation. They occur on gently to strongly sloping ridges and sideslopes. The surface layer is sandy and thicker than 20 inches. The subsoil is loamy or sandy. These soils are well drained to excessively drained. They are acid throughout and have low natural fertility. Because of the sandy textures, the water holding capacity is low and the soils are droughty during some periods in most years. They have a high potential for erosion. This combination of factors causes these soils to have a poor production potential, although locally they are planted to watermelons and other specialty crops.

6.2.1.4 Group IV - Soils on Flood Plains of Local Streams. The soils in this group are young and are forming in materials deposited by local streams and their tributaries. All are subject to some degree of flooding.

The Angelina Variant soils are the wettest of the group. They are very poorly drained and acid throughout. They occur in depressed areas primarily along Mill Creek and are submerged or have high water tables for long periods during most years. In places they have a marsh-type vegetation and lenses of decayed organic material throughout. They are unsuited for crop production.

Mantachie and Nahatche soils are in higher elevations within the flood plain and are not as wet as the Angelina Variant soils. They occur mostly along fairly wide flood plains. They are somewhat poorly drained but have high water tables only during wet periods, primarily during and immediately after flooding. They are loamy and acid throughout. They flood frequently enough in most places to prohibit row-crop production.

The Iuka soils are well-drained and are sandy throughout. They occur primarily along narrow creeks and tributaries of larger streams. Flooding is less frequent and of shorter duration than is common to other flood plain soils in the area. During wet seasons they have a water table at depths of one to three feet. Natural fertility is low and the soils are acid throughout. Where not flooded too frequently, these soils can be highly productive with additions of lime and fertilizer. Their narrow shape often prohibits economic cultivation with modern farm machinery, thus many areas are in trees or pasture.

6.2.1.5 Group V - Miscellaneous Land Types. Because it occurs in such small, scattered acres, this group could not be shown at the map scale presented in Fig. 6-6. It consists of miscellaneous areas in which iron ore, sand, clay or gravel have been excavated leaving pits of various depths. Little or no vegetation grows on these areas. Walls are slightly inclined to almost vertical and floors often contain water during wet periods.

6.2.1.6 Existing Prime Farmland Soils. Table 6-1 shows that 33.5 percent (8,365 acres) of the 23,983-acre study area and 34.3 percent (6,152 acres) of the 17,916-acre mine block area are prime farmland soils as defined under criteria listed in Federal Register Vol. 43, No. 21, January 31, 1978. In general, these are soils within the area that have: good soil moisture characteristics; a pH range that is not excessively limiting to crops; lack high water tables; do not flood frequently enough during the growing season to damage crops; lack high salt concentrations; are not steep enough to create an excessively high erosion potential; allow water and air to move at reasonable rates within the soils; and lack coarse fragments within the surface in quantities sufficient to significantly affect crop production or tillage operations. Map units comprising the prime farmland soils listed in Table 6-1 are in Groups I, II and IV with the majority in Group II. Studies (EH&A, 1981b) show that they qualify as prime farmland soils primarily because they meet the desirable characteristics listed above. The location of these soils is shown on Fig. 6-6. Although most are in pasture or woodland, they have the potential for producing cultivated crops. The majority, as is the case in most east Texas soils, need lime and fertilizer to reach maximum potential yields. Most respond well to high levels of management. For example, given the level of fertilizer applied during reclamation, production could be expected to be approximately double that of historical yields under low management practices (Bade, 1983).

6.2.2 Impacts of No Action Alternative

The impacts of the no action alternative on area soils depend primarily upon land use trends and management for the projected 30-year life of the mine. Assuming that past land use history trends continue, the area would be devoted primarily (92.1 percent) to pasture and forest uses. This vegetative cover would protect soils against accelerated erosion. An exception is small areas devoted to crops, primarily watermelons, on soils with thick sandy surfaces where erosion would continue to accelerate. Unless protective measures are taken, these soils could be seriously affected within 30 years.

6.2.3 Impacts of Project Alternatives

6.2.3.1 Introduction. As much as 17,916 acres within the project area could be disturbed by mining and the construction of haul roads and ancillary facilities. In addition, construction of the railroad and transmission line could disturb approximately 273 and 114 acres respectively. Table 6-1 shows the acreage of various soils map units within the mine block area. The actual acreage which would be disturbed by mining, haul roads and ancillary structures is less than 17,916 acres, as discussed in Sec. 5.2.2. Also, it should be noted that since the bottomland areas near streams generally will not be mined (Sec. 5.2.2), soils in Group IV will not be affected. A 2,000-foot stretch of Dry Creek is planned to be diverted to allow mining during the first five-year period. Impacts to the approximately five acres of prime farmland soils affected by the diversion are addressed in Sec. 6.2.3.4.

Impacts to soils are primarily associated with the removal of overburden to expose the lignite and with mine spoil handling prior to reclamation. Four alternative overburden handling procedures have been selected for analysis of impacts as discussed in Sec. 5.1.5. The major areas of concern when analyzing impacts to soils are: (1) Chemical and Physical Properties; (2) Erosion Potential; (3) Prime Farmland Soils; and (4) Reclamation Success. Impacts related to chemical and physical properties are primarily important from three aspects. First, the chemical and physical properties of the resulting surface layers are critical by supplying the necessary growth medium for revegetative efforts (i.e., nutrients and texture). Second, if the pH of the surface layer is too low (because of pyritic sulfur inclusions or other reasons), plant mortality may occur and/or metals (which are toxic to plants when dissolved) may be released. Third, low pH and/or metals dissolved in surface water may affect water quality (Sec. 6.4.3.4), wetlands (Sec. 6.5.3.2) or the aquatic ecosystem (Sec. 6.7.3). Impacts related to erosion are important because erosion (loss of surface soils) affects the growth medium available for plants and increases suspended solids (sediment) in surface waters which affect water quality, wetlands and the aquatic ecosystem.

Some of these areas of concern are affected similarly by the various alternative overburden handling techniques. Also, certain project activities, such as the construction of sedimentation ponds and transportation and ancillary facilities, are essentially the same regardless of the overburden handling procedure. Where no differences exist, the discussion applies to all four alternatives. The impacts discussed in Secs. 6.2.3.2 and 6.2.3.3 apply to all soils within the mine permit area. Specific impacts to prime farmland soils are discussed in Sec. 6.2.3.4 and reclamation success is discussed in Sec. 6.2.3.5.

6.2.3.2 Construction. Activities included under this category include construction of the ancillary facilities (loading station, sewage treatment plant, dragline erection pad, mine service area) (Fig. 5-5), railroad and transmission line (Fig. 5-4). The construction of haul roads (Fig. 5-6) and sedimentation ponds is included under operations.

The construction of the ancillary facilities would require about 140 acres, the railroad about 273 acres and the transmission line approximately 114 acres. These activities would constitute a long-term adverse impact to a total of approximately 527 acres of soils since reclamation could not occur at least until the end of the project life (about 30 years). Approximately 146 acres are prime farmland soils (see Sec. 6.2.3.4).

The primary impacts would be increased erosion potential caused by clearing prior to construction and disruption of the physical properties of the soils. Erosion impacts (removal of the soil surface and increased sediment (see Secs. 6.4.3.4, 6.5.3.2 and 6.7.3) in streams) would be short-term and controlled by proven measures such as the use of hay bales, mulches and catchment basins. Revegetation of cleared areas as soon as possible after construction would minimize erosion impacts. Disruption of the physical properties of the soils by cut and fill activities represents an irreversible long-term impact on the soils. The actual percent of the total 527 acres affected by these activities cannot be presently determined.

6.2.3.3 Operations. The impacts of chemical and physical properties on postmined soils depend on the nature of overburden materials and on overburden handling procedures. The nature of the overburden has been characterized through a program of sampling and analysis (Appendix D) and the development of geological cross-sections within the project area (Sec. 6.1.3). Five sites (Fig. 6-2) were chosen to: (1) yield as many different combinations of sediment and depositional environment types as possible to provide data on lithologic types to be excavated and reclaimed; (2) provide spacing that would minimize bias caused by grouping of locations and to divide the area as nearly as possible; and (3) to locate core hole sites near previously logged exploration holes to maximize replicability of the various depositional environments depicted.

Complete physical and chemical data from the core holes are compiled elsewhere (Appendix D). Calculated ranges of selected chemical and physical properties based on those data are used in Table 6-2 to indicate the trends in ranges of properties for postmined soils that could be expected under the various overburden handling techniques. The ranges were calculated using the weighted averages of the physical and chemical data from the overburden analyses of the five cores. For example, to determine the available

TABLE 6-2

CALCULATED RANGES OF SELECTED CHEMICAL AND PHYSICAL PROPERTIES POTENTIALLY RESULTING FROM DIFFERENT OVERBURDEN HANDLING TECHNIQUES

Alternative	Calculated Ranges					Potential for Release of Elements Toxic to Plants[2]	Major Potential Problems
	Texture	Available Water (%)	CEC (me/100 g soil)	pH	Potential Acidity[1]		
1. Mixed Spoil	Loamy sand to clay loam	4.3-11.9	5.2-14.1	3.9-7.3	0-27.5	Greatest	High potential acidity in localized areas; possible migration of heavy metals; crusting in some areas; low fertility; potential seed mortality.
2. Topsoil over Mixed Spoil	Loamy fine sand to sandy clay loam	6.2-14.8	8.9-13.3	4.2-5.1	0-2.4	Possible	Possible areas of clayey soils; low infiltration rates; crusting, seed mortality
3. Topsoil plus Oxidized over Unoxidized	Sandy loam to clay loam	5.6-12.0	6.1-12.5	3.9-5.6	0-11.1	Possible	High potential acidity in localized areas; possible migration of heavy metals in small areas; crusting in some areas; low fertility.
4. Topsoil over Oxidized over Unoxidized	Loamy fine sand to sandy clay loam	6.2-14.8	8.9-13.3	4.2-5.1	0-2.4	Least	Possible areas of clayey soils; low infiltration rates; crusting, seed mortality
5. Existing soils[4]	Loamy fine sand to loam	3.3-13.8	1.3-7.2	4.4-6.1	1.5-3.0[3]	None	Low water holding capacity in some; need lime and fertilizer

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[1] Tons of $CaCO_3$ needed per acre to neutralize a six-inch layer of soil.

[2] Some elements toxic to plants could become mobile at pH less than 4.0.

[3] Acidity is due to leaching of bases during soil development, not pyritic material.

[4] Ranges for existing soils are for the surface layer. Calculated ranges for four alternatives are based on homogeneous mixtures for comparative purposes (although actual mixture will not be homogeneous) and should be considered to represent the surface layers. Ranges for Alternatives 2 and 4 include the possibility of mixing topsoil horizons A and B.

Source: Soil data from EH&A, 1981b; Chemical and Physical properties from Appendix D (EH&A, 1981a).

water resulting from Alternative 1, each core was considered separately. The percent available for each segment of the core was listed and weighted according to the length of the segment. Then, since the alternative considers a total mix, the weighted averages were averaged to provide a percent available water in a theoretical homogeneous mixture of overburden represented by that core. The ranges given for each alternative reflect the differences between cores. The same basic procedure was followed for each alternative except that each core was divided into layers to reflect differences in handling techniques (i.e., alternative 2 was divided into a topsoil layer and a layer representing the remainder of the material, etc.). The calculated ranges given represent the layer nearest the surface. The ranges given for topsoiling alternatives (2 and 4) pertain primarily to those of the existing A horizon but include ranges of a mixture of A and B horizons where the thickness of the present A horizon is insufficient to provide adequate topsoiling material. This table is not intended to infer that a homogeneous mix could be obtained under any handling procedure nor that any procedure could precisely recreate an existing soil (Grandt, 1982). The table serves as a basis for comparing the potential impacts resulting from differences in handling procedure. All of the overburden handling techniques would create long-term, irreversible impacts to soil composition and horizon sequence but this is not necessarily an adverse impact to crop productivity.

Alternative 1. Core data indicate that all but one of the five cores contain layers above the lignite seams in which potential acidity exceeds the neutralization potential by a considerable margin. Placement of such layers on the surface would create long-term, adverse impacts in the form of excess acidity and the potential release of heavy metals which are toxic to plants. With few exceptions, these materials lie above and adjacent to the lignite. Selective burial of such layers would reduce the potential for excess acidity on a large scale. Thin layers of acid producing materials (pyrites) at shallower depths and not easily detected would undoubtedly appear on the surface in small, localized areas, creating adverse impacts of excess acidity and heavy metal release. Both OSM and RRC regulations require that vegetation must be established. With the use of lime to neutralize acid, reburial of the acidic surface layer and/or covering the area with topsoil, impacts from excess acidity and release of heavy metals are reversible and short term. Short-term (one to two years), adverse impacts would result from low fertility, low organic matter, low soil microbial population, lack of surface structure and surface crusting. These would be reversed as fertilizer is applied and vegetation reestablished (Fresquez and Lindemann, 1982).

The core data indicate that surface and subsurface textures would range from loamy sand to clay loam. Actual textures would include loamy sand, sandy loam, sandy clay loam and clay loam. The majority of these textures would provide a higher available water and cation exchange capacity in postmining surface layers than is found in surface layers of most of the existing soils. This offers a potential for long-term, beneficial impacts to plant yields, particularly cultivated crops and pasture. This is true particularly for the soils of Groups III where thick sandy surfaces are presently limited by their droughty nature.

Based upon assumptions given in Sec. 5.1.5, Alternative 1 would continually expose approximately 78 acres to erosion (land cleared ahead of mining, spoil piles and areas leveled and graded but unvegetated). For any given acre of land the impact would be short term but there would be long-term impacts from erosion on 78 acres.

Alternative 2. Topsoil, as defined here, consists of the surface layers (A horizons). Where these are thin, topsoil might also include the B and, in some instances, the C horizons of existing soils. The short-term benefits of this procedure compared to mixed spoil are that soil structure is maintained from the beginning and, generally speaking, organic matter content is higher. If stockpiled for long periods of time, the microbial count would be lowered (Fresquez and Lindemann, 1982). This is a short-term, adverse impact which is reversed as vegetation is reestablished. There would be no adverse impacts from pyrites on the surface. In localized areas where replaced topsoil is thin, it is possible that subsurface pyrites (still in the root zone) could adversely affect revegetation success. Compaction due to increased scraper traffic while replacing surface layers would create adverse impacts by reducing soil permeability. The lasting effects and reversibility of these impacts are not conclusively known at this time.

A potential for long-term, beneficial impacts would be lost where the thick sandy surfaces in soils of Group III are used as topsoil material. While the reconstructed soil resulting from Alternative 2 might have a productive capacity equal to that of the existing soils in this group, production on these soils could be improved under Alternative 1 by replacement of the thick droughty surfaces. Where the clayey B horizons of the Cuthbert and Kirvin soils in Groups II appear as surface layers (should A horizons be too thin to provide topsoiling material), there would be long-term, adverse impacts under Alternative 2, associated with the excessively clayey surface. These include poor tillage characteristics, increased water runoff and poor seedling survival.

Based upon assumptions given in Sec. 5.1.5, Alternative 2 would continually expose approximately 164 acres (land cleared ahead of mining, areas with topsoil removed, spoil piles, graded and leveled areas and areas of replaced topsoil before revegetation occurs) to erosion with short- and long-term impacts as described previously.

Alternative 3. A depth of 20 feet was chosen for discussing impacts of using the combined topsoil and oxidized layers over unoxidized material. Core data indicate that 20 feet is the average thickness of the oxidized zone (although this zone ranges above and below 20 feet). As with a random mixed spoil, the postmined soils would have heterogeneous features not found in the existing soils. Table 6-2 shows that lime requirements to neutralize potential acidity would range from 0 to 11.1 tons per 1,000 tons of material. Higher values are attributed to thin, potentially acidic layers (related to high pyrite concentrations) in cores 562 and 972. Such layers can appear even in oxidized zones since oxidation may not be complete. The other three cores and remaining layers within these two cores have lime requirements ranging from 0 to about 2.6 tons per 1,000 tons of material, which is comparable to that of the existing soils within the area. Because mixing is not homogeneous, small localized areas having a high potential acidity might appear in places on the surface. These adverse impacts would be short term and reversible. Corrective measures which would be taken include liming, reburial and/or topsoiling. Unoxidized overburden would be buried to depths of at least 20 feet and would have no impacts on the post-mined soils.

Surface and subsurface textures would range from sandy clay to clay loam, including sandy clay loam. In general, higher clay content in surface layers would have short-term, adverse impacts from surface crusting, lower organic content and decreased microbial populations. These impacts would be reversed as vegetation is reestablished. Surface and subsoil compaction caused by scrapers used for replacement of the oxidized layer would result in decreased soil permeability and greater difficulty in root penetration. Whether these adverse impacts could be reversed and the time needed for correction is not presently known. Long-term, beneficial impacts would be increased water holding capacity and cation exchange capacity within surface layers, compared to surface layers in the majority of the existing soils.

Based upon assumptions given in Sec. 5.1.5, Alternative 3 would continually expose about 164 acres (land cleared ahead of mining, land where oxidized layer is removed, soil piles, and areas of replaced oxidized layer before revegetation occurs) to erosion with short- and long-term impacts as previously discussed.

Alternative 4. Because topsoiling in this alternative is the same as that described for Alternative 2, surface characteristics and potential impacts are similar. The underlying spoil would be similar to that described in Alternative 3. This alternative would expose approximately 179 acres (land cleared ahead of mining, land where topsoil is removed, land where oxidized layer is removed, spoil piles, replaced oxidized layer and replaced topsoil before revegetation occurs) to erosion with impacts similar to those discussed for Alternative 1.

Summary. The potential for pyritic materials within surface layers is greatest for Alternative 1 but is less for Alternative 3. This is an adverse, short-term, reversible impact. The time period over which problems with pyrites at the surface may occur is longer for Alternative 1. Each alternative (unless only A horizons are used for topsoiling in Alternatives 2 and 4) would produce more clayey surface layers. In most of the soils, this would result in long-term, beneficial impacts to plant productivity due to higher water holding capacity and cation exchange capacity. Short-term, adverse impacts would be caused by crusting and lower amounts of organic matter and microorganisms.

There would be minor adverse impacts from erosion regardless of alternative, until the less stable postmined system becomes stabilized by the reestablishment of an adequate ground cover. These would be short-term impacts because of RRC requirements on ground cover establishment. With respect to potential adverse impacts caused by erosion, Alternative 4 would have more impacts because of larger areas of unrevegetated surface exposed and Alternative 1 would minimize those impacts. A partial tradeoff might be expected since topsoiling could allow a stable vegetative cover to develop more rapidly under low levels of management.

Regardless of the alternative overburden handling procedure used, the project would require a network of haul roads. Haul road construction also would result in minor adverse impacts caused by erosion. Proper care in selecting the time and method of construction and equipment used, in conjunction with revegetation and other erosion control procedures, would minimize the impacts from these activities.

Apart from prime farmland soils (Sec. 6.2.3.4) many soils can benefit from drastic disturbance (Smith and Sobek, 1978). Productivity on some postmined soils in Texas has been estimated by OSM, RRC and SCS to equal or exceed that of certain native soils. Several soils within the project area have physical and chemical properties that could be improved by any of the overburden handling techinques considered. For example, substitution of less sandy surface materials in soils of Group III would improve physical characteristics which, in turn, could improve plant productivity. Moderation of the clay subsoils (Sec. 6.2.1.2) in the Cuthbert and Kirvin soils of Group II could also provide a medium for improved plant productivity. Both examples would provide long-term, beneficial impacts insofar as productivity on these soils is concerned.

6.2.3.4 Prime Farmland Soils.

Introduction. Prime farmland soil is defined in Federal Register (Vol. 43, No. 21, January 31, 1978) as

> land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops, and is also available for these uses (the land could be cropland, pastureland, rangeland, forest land, or other land, but not urban built-up land or water). It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods.

The State Conservationist, SCS, is charged with preparing a statewide list of soil mapping units that qualify as prime farmland soils under the above criteria. EPA's policy to Protect Environmentally Significant Agricultural Lands addresses prime farmland soils so determined. The Texas Coal Mining Regulations (January 1, 1981, RRC) provide additional stipulations to the definition set forth in the Federal Register which generally have reduced prime farmland acreage protection for land to be mined. These state that land shall not be considered prime farmland where the applicant can demonstrate, among other criteria, that the land has not been historically used as cropland. "Historically used for cropland" is defined in Section .138 of the Texas Coal Mining Regulations as: (1) lands that have been used for cropland for any five years or more out of the 10 years immediately preceding the acquisition, including purchase, lease or option, of the land for the purpose of conducting or allowing through resale, lease or option the conduct of surface coal mining and reclamation operations; (2) lands that the Commission determines, on the basis of additional cropland history of the surrounding lands and the lands under consideration, that the permit area is clearly cropland but falls outside the five-years-in-10 criterion, in which case the regulations for prime farmland may be applied to include more years of cropland history only to increase the prime farmland acreage to be preserved; or (3) lands that would likely have been used for cropland for any five out of the last 10 years, immediately preceding such acquisition but for the same fact of ownership or control of the land unrelated to the productivity of the land. "Cropland" in the above regulations means land used for the production of adapted crops for harvest, alone or in rotation with grasses and legumes, and includes row crops, small grain crops, hay crops, nursery crops, orchard crops and other similar specialty crops.

Construction. Construction of the ancillary facilities. railroad spur and transmission line would require disturbing a total of approximately 146 acres of prime farmland soils. As much as 70 acres of prime farmland soils might be disturbed by construction of the ancillary facilities area. Some of this acreage would be physically altered for construction of buildings, roads, parking lot, dragline erection pad, etc. The remaining acreage (although unaltered) would be unavailable for agricultural use for the life of the project (about 30 years). The railroad right-of-way might affect as much as 46 acres of prime farmland soils. Construction of the railroad would require cut and fill activities along the right-of-way to provide a road base with the proper grade and consistency for placement of the rail tracks. The cut and fill would be accomplished by excavation of soils from areas requiring a reduction in elevation and placement in areas requiring fill or embankment. The relocated soils would remain in the general area and would be available for other use after the useful life of the railroad. The upper four inches of soil are generally unsuitable for fill material because of possible high content of organic material. Construction procedures would include the removal of at least the top four inches of soil from areas designated to be excavated or to be covered by fill. This material would be placed along the right-of-way and placed over completed work areas where praticable. A grass cover would be established over all disturbed areas as the final step of construction. Transmission line construction could affect as much as 30 acres of prime farmland soils. Since only the construction of tower bases should directly affect the soils, much less than 30 acres would be disturbed. All prime farmland soils within the transmission line right-of-way might be unavailable for agricultural use.

The disturbance of 146 acres is considered a long-term adverse impact to prime farmland soils. This impact is irreversible (therefore significant) for a presently unknown portion of the 146 acres but reversible for the remaining acreage.

Operations. Table 6-1 shows prime farmland soils according to the SCS definition for both the study area of 24,963 acres and for the generalized mine block (Fig. 1-2) area of 17,916 acres. Excluding bottomland soils (Group IV), which generally would not be mined, there are 5,232 acres (29.2 percent) of prime farmland soils within the mine block area.

Approximately 5 acres of Iuka soil would be disturbed by the temporary diversion of a 2,000-foot section of Dry Creek. EPA recommends removal and replacement of the topsoil on this acreage to provide the most rapid revegetation and potentially least impacts from erosion. TUGCO estimates that only about 10 acres or less of other prime farmland soils would be considered under the RRC criteria as prime farmland. RRC regulations require different standards for handling and reclamation on RRC designated prime farmland as compared to other soils. Thus, on about 10 acres of prime farmland soils (from a total of 5,232 acres), TUGCO might be required to remove and/or stockpile the A and B (and possibly C) horizons separately prior to mining. Before reclamation, these horizons would be replaced in their same relative positions. For determining reclamation success, TUGCO would be required to show that a three-year average annual crop production was equivalent to or greater than the predetermined target level of crop production on non-mined prime farmland soils of the same soil unit in the surrounding area under equal levels of management.

The remaining approximately 5,220 acres of prime farmland soils would fall under less stringent standards for handling and reclamation according to RRC regulations. TUGCO could be allowed to use any one of the four alternatives for overburden handling, none of which would require separate removal and/or stockpiling of individual horizons. The ground cover and productivity of a revegetated area are considered equal if they are at least 90 percent of the ground cover and productivity of a reference area with 90 percent statistical confidence (or with 80 percent statistical confidence on shrub lands) or ground cover and productivity are at least 90 percent of the standards in an approved technical guide. For areas to be used for cropland, success in revegetation is determined on the basis of crop production from the mined area as compared to approved reference areas or other technical guidance procedures. Crop production from the mined area must be equal to or greater than that of an approved standard for the last two consecutive growing seasons of the 5- or 10-year liability period established by the RRC. Production will not be considered equal if it is less than 90 percent of the production of the approved standard with 90 percent statistical confidence. On areas to be developed for fish and wildlife management or forestland, success of vegetation will be determined on the basis of tree, shrub or half-shrub stocking and ground cover. The area stocked with woody species is acceptable if the established woody plants are equal to or greater than 90 percent of the stocking of live woody plants of the same life form on an approved reference area with 80 percent statistical confidence. The area seeded to a ground cover shall be considered acceptable if it is at least 70 percent of the ground cover of the reference areas with 90 percent statistical confidence or if the ground cover is determined by the RRC to be adequate to control erosion. The above standards comply with standards and specifications developed by the SCS for reconstruction of currently mined land in Texas (SCS, 1982).

In accordance with EPA policy (EPA, 1978), the loss of as much as 5,220 acres of prime farmland soils would be considered a long-term, irreversible, adverse impact to those soils. The agricultural productivity of those soils would likely be lessened, based on determining reclamation to be successful at levels of 90 percent of reference areas. In theory, using only physical and chemical parameters, the question has been raised whether reclaimed spoil could qualify as prime farmland soils (Grandt, 1981). Favorable experience (Thompson, 1982) has occurred with productivity of reclaimed spoil, at the Big Brown mine in Freestone County, Texas, compared to the original soils at that site.

6.2.3.5 Reclamation Success. One major factor affecting reclamation success is the potential for increased acidity caused by oxidation of pyrites in the spoil and the associated release of heavy metals. Acid production from pyrites is a complex process and is affected by certain bacteria, temperature, time between flushing of accumulated materials, the size of pyrite particles and the permeability and porosity of the spoil material. The rate of production of acidity from pyrite materials is not constant through time and it is almost impossible to predict the amount of time required to oxidize all pyrites from any given spoil material. Von Demfange and Warren (1975) found that, in spoil material in Henry County, Missouri, over 90 percent of the pyrites had been oxidized within eight years or less without addition of lime. The addition of lime not only neutralizes the acidity but tends to reduce the rate of oxidation. Thus, addition of lime to control acidity from pyrites during early phases of reclamation could extend the time during which increased amounts of lime would be required. A variety of other factors (including texture, soil fertility, water holding capacity, etc.) also affect reclamation and revegetation success.

The impacts on reclamation success for this project have been partially addressed in Sec. 6.2.3.3. As stated, Alternatives 1 and 3 have the potential to result in localized areas ("hot" spots) with low surface pH and the release of heavy metals. The potential for these adverse impacts (also see Secs. 6.4.3.4, 6.5.3.2 and 6.7.3) would be reduced by selective placement of undesirable material but could not be completely eliminated. In addition, calculations (Table 6-2) indicate that, even with selective placement, fertilizer and lime would be required for successful reclamation. However, it must be remembered that the existing soils (for different reasons) also require fertilizer and lime for successful production. Bade (1983) states that existing soils in the project area require (varying among Soil Groups I through IV on Table 6-1) from 50 to 60 lb of nitrogen, 20 to 30 lb of phosphorus and 0 to 30 lb of potassium per year to maintain average yields. To reach their potential yields these same soils require from 100 to 130 lb of nitrogen, 40 lb of phosphorus and 0 to 40 lb of potassium per year. At the existing Martin Lake mining area "C", TUGCO applied an average (1981) of 80 lb of nitrogen, 91 lb of phosphorus and 135 lb of potassium to obtain high yields on reclaimed spoil. TUGCO also applied an average of 2 lb of lime per acre. The fertilizer requirements cannot necessarily be exactly compared since the SCS figures are based upon requirements for soil types and the TUGCO figures are based upon site specific soil analyses. A site specific soil analysis of the Sacul, fine sandy loam soil in Area "C" showed requirements of 80 lb of nitrogen, 90 lb of phosphorus and 140 lb of potassium to reach high yields. Alternatives 2 and 4 (topsoil replacement) would have even less potential for impacts from acidity if the A, B and C horizons were used. However, these soils would still require fertilizer and lime. The mixture of the more clayey B and C horizons with the A horizon would result in a more clayey surface and minor short-term, adverse impacts to plant growth and surface water runoff could result. Use of only the thin A horizon would increase the potential for impacts from low pH and heavy metals. Regardless of the alternative used, successful reclamation would probably require occasional removal of the surface layer in localized parts of the reclaimed area and replacement with other material. Replacement of the surface layer could extend the time required before release from bonding since the period of extended responsibility would not start until a vegetative cover was established. Alternative 4 would require the least amount of surface replacement.

At the Martin Lake "D" Area (like other TUGCO mine areas), a program would be initiated to monitor reclamation success and the impacts of pyrites in surface soils. Periodic sampling of soils and monitoring of vegetation growth would be conducted by TUGCO and the RRC to identify any potential problem areas and to determine what corrective action should be taken. After completion of spoil leveling and grading, initial soil samples would be collected to a depth of four (4) feet. The four-foot samples would be divided into three (3) segments: (1) 0 to 6 in.; (2) 6 to 18 in.; and (3) 18 to 48 in. Soil analyses would be conducted for each interval including pH, salinity, nutrients, trace elements, base saturation percentage, texture, etc. Samples would be collected and analyzed again at yearly intervals for at least five years until bond release for each tract of land. In addition to annual soil monitoring, the vegetation planted during reclamation would be monitored as an indicator of near surface pyritic material. Should a potential problem area be identified by a lack of vegetative vigor or downward trend in pH in a reclamation area, additional soil samples would be collected and tested for pyritic sulfur, neutralization potential and lime requirements to bring the soil pH up to 8.1, and other tests as needed to determine the extent of the problem would be conducted. To further ensure reclamation success in relation to local needs and desires, TUGCO plans to enter into a cooperative agreement with the Rusk County Soil and Water Conservation District.

It appears that reclamation success is possible regardless of the overburden handling technique used. Fertilizer and lime additions would be required under all alternatives and would be greatest under Alternative 1. Alternative 1 would also have the greatest potential for increased lime requirements after release from bond while Alternative 4 would have the least potential. In compliance with paragraph 335(e) of the RRC surface mining regulations (RRC, 1981), TUGCO is presently conducting greenhouse studies to determine the suitability of using the proposed overburden handling technique (Alternative 1). The data from these tests are not presently available for comparison to predictions, in this document, based on the chemical and physical characteristics of the overburden. Regardless of the overburden handling alternative used, reclamation success would be determined according to the applicable standards discussed in Sec. 6.2.3.4.

6.3 GROUND-WATER RESOURCES

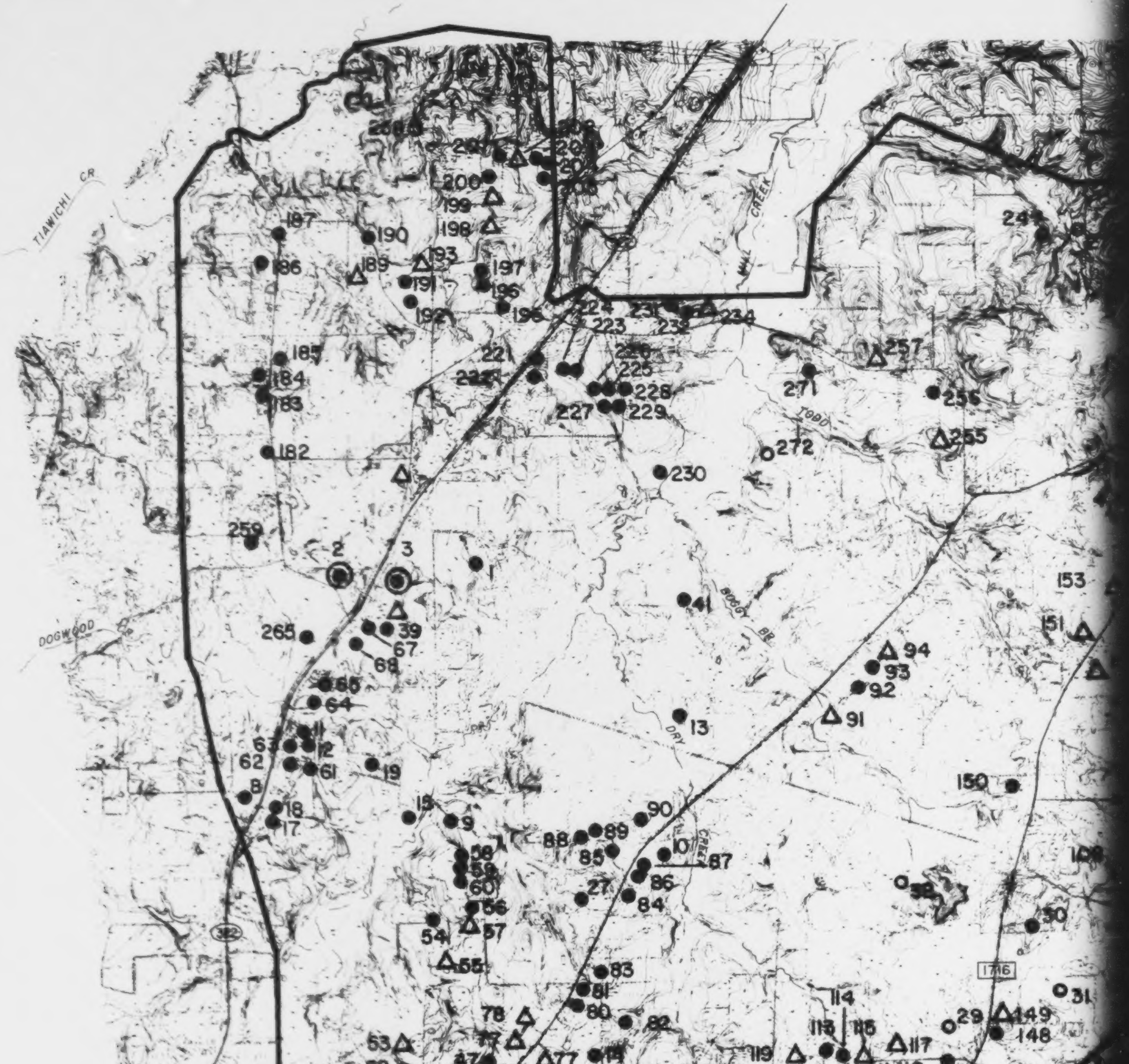
6.3.1 Existing Environment

Of the four different geologic units described in Sec. 6.1.1, only the Wilcox Group and Carrizo Formation are of geohydrologic importance with respect to the proposed mining operation. The alluvial deposits and the Reklaw Formation are both too thin and areally restricted to contain significant amounts of ground water. Their only hydrologic function is to transmit some recharge from precipitation downward to the Carrizo Formation and Wilcox sediments. There are two basic ground-water systems in the project and adjacent area: (1) a shallow system composed of the very sandy Carrizo Formation and upper Wilcox Group; and (2) a deep system consisting of sand channels and beds of the lower Wilcox Group. The lignite seam to be mined is contained in the shallow ground-water system.

Ground water in the shallow system occurs under water-table (unconfined) conditions. Depth-to-water measurements, determined from overburden core holes at the site and driller's logs in the files of the Texas Department of Water Resources (TDWR), indicate that the water table ranges from 5 to 50 feet below ground surface, with most levels occurring between 5 and 15 feet. Since the Carrizo is only 10 to 20 feet thick in the project area, most of the ground water in the shallow system is from the upper Wilcox sediments. Because the water table is subject to level drops during extended dry periods, the Carrizo's importance as an aquifer is very limited. In 1981 EH&A conducted a water well survey of the project area. This survey consisted of compiling a list of wells from TDWR records and a house-to-house field survey to verify the location given in the records as well as to locate those not given in the records (Appendix F). Two hundred eighty six (286) wells were located, of which 196 are within the project boundary and 90 are within a one-mile wide strip outside the boundary (Fig. 6-7). Approximately 54 of the 196 wells within the boundary are abandoned, leaving 142 active wells. About 93 percent of the total 286 wells surveyed are less than 300 feet deep, and the great majority of these are less than 100 feet deep. About 210 of the total of 286 wells are believed to be less than 90 feet deep. It appears that the shallow aquifer system, particularly the upper Wilcox, is a primary source of ground water in the project area. Most of these shallow wells are for domestic and stock use; withdrawal is generally on the order of a few hundred gallons per day.

Aquifers in the deep ground-water system exist as channel sands or sand beds that are confined by overlying, underlying and adjacent sediments which are less permeable (Sec. 6.1.1). Figure 6-8 shows a generalized potentiometric (water table) map of the lower Wilcox. All public supply wells, most industrial wells and some domestic wells in the project area obtain ground water from the deeper Wilcox aquifers (400 to 800 feet). In general, greater yields and better quality water are available from the deep aquifers, as opposed to the shallow system.

6.3.1.1 Ground-water Recharge and Movement. Recharge of the shallow aquifer system occurs primarily through infiltration of precipitation falling on the land surface. Once the infiltrating water reaches the water table, its movement is largely controlled by topography and, to a lesser extent, by the influence of shallow, pumping wells. Ground-water discharge occurs in the form of seeps and springs that flow into various surface-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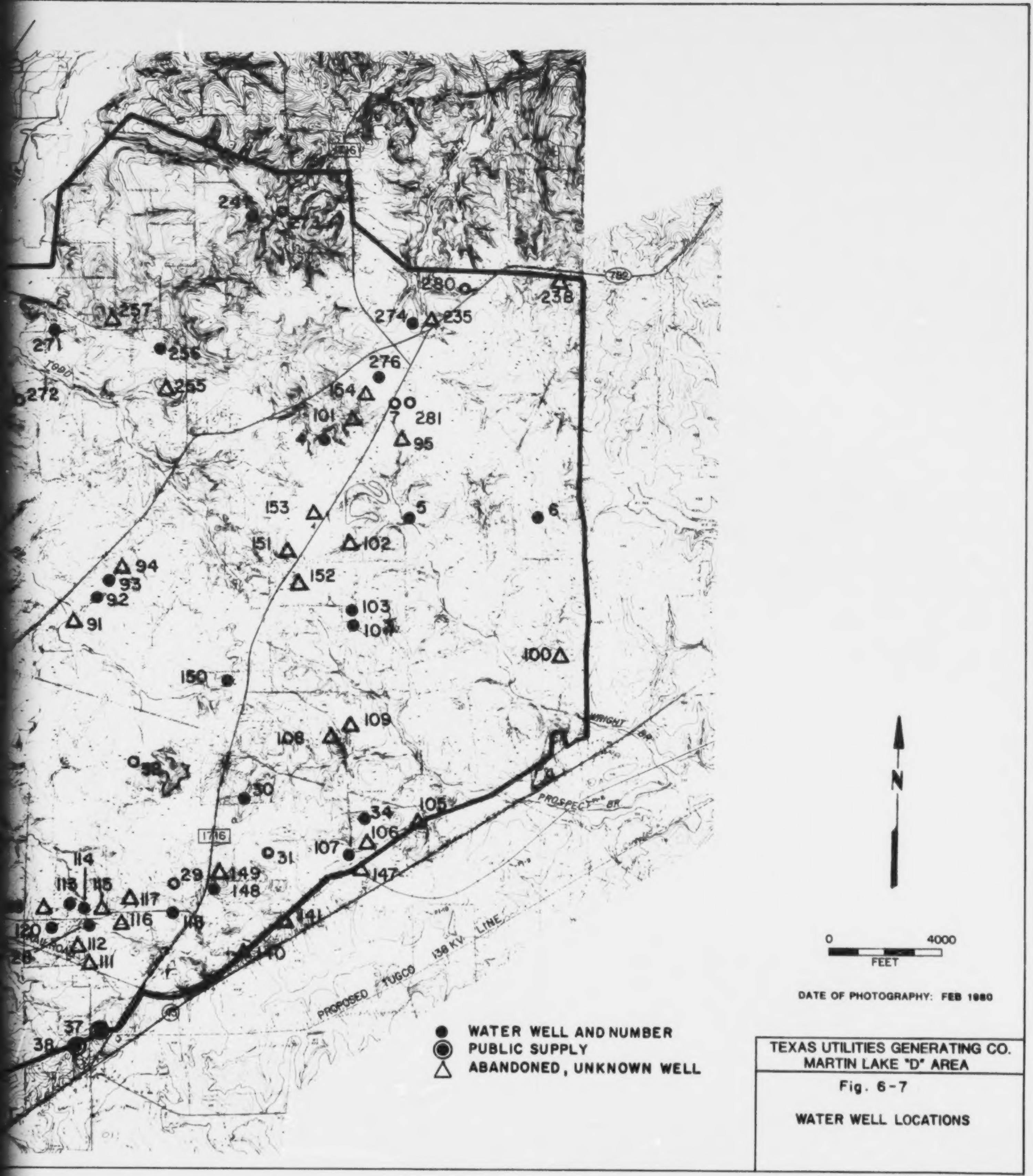
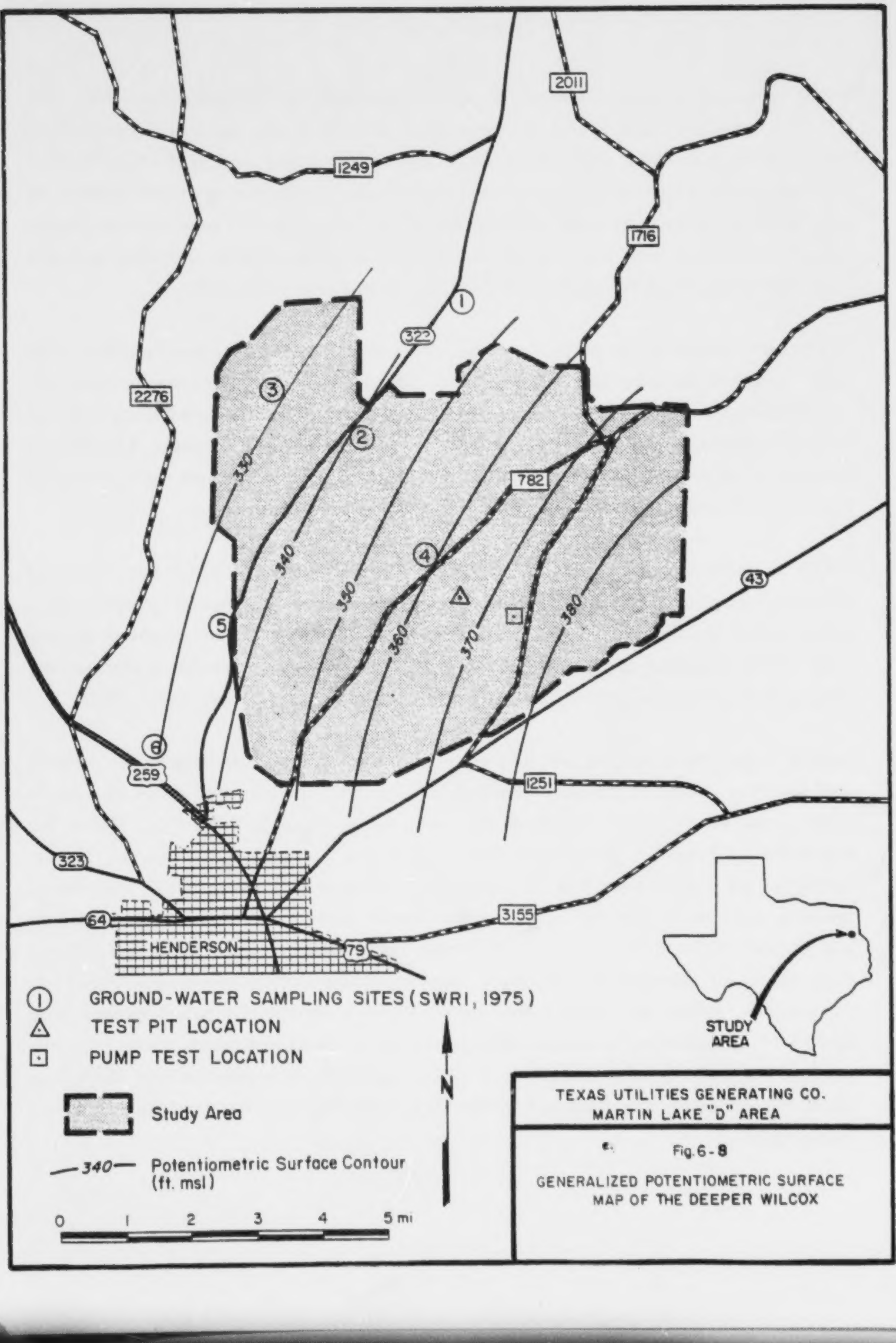


DATE OF PHOTOGRAPHY: FEB 1980

TEXAS UTILITIES GENERATING CO.
MARTIN LAKE "D" AREA

Fig. 6-7

WATER WELL LOCATIONS



TEXAS UTILITIES GENERATING CO.
MARTIN LAKE "D" AREA

Fig. 6-8

GENERALIZED POTENTIOMETRIC SURFACE MAP OF THE DEEPER WILCOX water bodies, as downward leakage through low permeability, confining strata (i.e., clay, silt, etc.), locally through hydrologic connections into the deeper aquifers and as yield to shallow wells in the area. Hydrologic connections are typically local sand channels which cut through the low permeability clays and silts. Total leakage through these connections is probably minor since the sand channels which cut through the low permeability deposits are not typically of large areal extent and clays in the deeper Wilcox formation typically have a permeability of less than 1×10^{-7} cm/sec (Mathewson et al., 1982).

The deeper aquifers in the project area are recharged primarily by subsurface flow from updip areas off the mine site and to a small degree by the downward leakage from the overlying shallow aquifers. The confined ground water generally flows northwestward along the gently dipping strata through subsurface sand beds and channels. Locally, the flow can be influenced by pumping wells. Discharge of this deep ground water occurs as flow, in the downdip direction away from the site, and as yields to wells.

6.3.1.2 Hydrologic Properties of Aquifers. No site-specific hydrologic data are available for the Carrizo Formation. However, a series of aquifer pumping tests performed in the East Texas Embayment yielded coefficients of transmissivity ranging from 14,000 to 22,000 gpd/ft (gallons per day per foot) and coefficients of permeability ranging from 128 to 246 gpd/ft^2 (gallons per day per square foot) (Baker et al., 1963).

TUGCO conducted a pumping test (Fig. 6-8) in the project area, consisting of one pumping well and five observation wells completed into the Wilcox Group just above the lignite seam to be mined. The results of this test are provided in Table 6-3. Values for transmissivity ranged from 6,712 to 20,952 gpd/ft and averaged 14,296 gpd/ft. Permeability values ranged from 164 to 511 gpd/ft^2 and averaged 349 gpd/ft^2. Regionally, however, sands of the Wilcox Group generally exhibit lower coefficients of transmissivity and permeability. Baker et al. (1963) report transmissivity values between 1,300 and 5,300 gpd/ft for individual Wilcox sands. Corresponding permeabilities ranged from 16 to 119 gpd/ft^2. Broom and Myers (1966) report Wilcox transmissivity values ranging from 1,900 to 5,500 gpd/ft from several tests performed in Harrison County, Texas. Corresponding permeability values ranged from 17 to 72 gpd/ft^2. It is apparent that the Wilcox Group has highly variable hydrologic properties, depending upon the particular sand body being tested.

TABLE 6-3

SUMMARY OF PUMPING TEST ANALYSES

Pumping Well	Pumping Well Depth (ft)	Pumping Rate (gpm)	Specific Capacity (gpm/ft drawdown)	Observation Well(s) Used in Analysis	Method of Analysis	Transmissivity (gpd/ft)	Permeability (gpd/ft^2)	Storage Coefficient (Dimensionless)	Leakance (gpd/ft^3)
PW-3	137	150	5.2	OW-5	Leaky Artesian	15,627	381	.0001	.0077
				PW-3	Time-Drawdown	6,712	164		
				OW-5	Time-Drawdown	13,200	322	.0001	
				PW-3, OW-1, OW-2, 3 & 4	Distance-Drawdown	9,209	225		
				OW-1	Recovery	14,831	362		
				OW-2	Recovery	14,348	350		
				PW-3	Recovery	14,559	355		
				OW-4	Recovery	20,952	511		
				OW-5	Recovery	19,223	469		
					Average	14,296	349	.0001	.0077

Source: TUGCO, 1981.

To determine pre-mine recharge capacity of surface soils within the project area, infiltration tests were performed by EH&A (1981). Tests were conducted for an average of four hours. Measured infiltration rates varied from 0.09 in./hr (1.35 gpd/ft^2) to 4.02 in./hr (60.14 gpd/ft^2). These rates are slow to moderate and are consistent with the hydrologic soil groups at the site. It should be noted that actual infiltration rates vary, depending on intensity and duration of rainfall, slope, vegetation, evaporation, and initial soil moisture conditions.

6.3.1.3 Ground-water Quality. Baseline ground-water quality information for the mine area consists of field data collected by Southwest Research Institute (SWRI, 1975) and by TUGCO during an aquifer pumping test and test pit study (see Fig. 6-8 for the location of sampling sites). A summary of the data is presented in Tables 6-4 and 6-5. Approximately 50 percent of the SWRI samples were high in phenol content; about 30 percent of the samples exceeded the irrigation water standard for mercury; and about 20 percent of the samples exceeded the drinking water standard for mercury. The high phenol content is probably a natural phenomenon related to the organic nature of the Wilcox. High mercury concentrations are usually associated with polluted water. However, since there are no apparent sources of ground-water contamination, these concentrations are either from natural sources or reflect anomalies in the chemical analyses. Confirmation (check) samples and analyses would be required to determine if these data were anomalous or accurately represented the levels of these constitutents. Of 42 SWRI pH measurements, 11 exceeded the proposed standard for drinking water, but only 2 exceeded the existing irrigation standards.

Of the TUGCO samples, the pH of the test pit sample was below drinking and irrigation standards, and the total suspended solids of the test pit sample was relatively high. The low pH value for the test pit does not appear to be consistent with other site specific data but cannot be discounted without further verification. The high iron concentration may reflect the high concentration of suspended solids in the test pit sample since it is expressed as total iron instead of dissolved iron. Manganese concentration in the well sample slightly exceeded the drinking water standard.

In summary, it appears that ground water in the shallow aquifers of the mine area is slightly acidic, but becomes more alkaline with depth. This is typical of the chemical

TABLE 6-4

EXISTING GROUND-WATER QUALITY
MARTIN LAKE "D" AREA

Parameter	No. of Samples	Samples			Standards		
		High	Low	Avg	Drinking	Irrigation	Livestock
Alkalinity	42	181	1.1	60.94	500	—	—
Ammonia	42	0.45	<0.05	0.11	0.5	—	—
Arsenic	14	0.039	< 0.005	0.009	0.05	10	0.2
Barium	12	< 0.002	< 0.002	0.002	1.0	—	—
Boron	38	1.775	< 0.001	0.300	—	—	—
Cadmium	36	0.001	<0.0005	0.0006	0.01	100	0.05
Chloride	42	17.3	< 0.4	6.72	250	—	—
Chlorine	39	0.2	< 0.2	0.2	—	—	—
Chromium	14	< 0.005	<0.005	0.005	0.05	0.1	1.0
Copper	14	1.521	0.004	0.214	1.0	0.2	0.5
Cyanide	42	0.050	< 0.001	0.0037	—	—	—
Dissolved Oxygen	42	10.2	1.6	6.88	—	—	—
Fluoride	12	0.78	0.1	0.29	1.8	2.0	2.0
Iron	36	0.026	< 0.001	0.0064	0.3	5.0	5.0
Lead	14	0.012	< 0.001	0.0033	0.05	5	0.1
Manganese	36	0.006	< 0.0003	0.0007	0.05	0.2	—
Mercury	42	0.092	< 0.0005	0.006	0.002	0.001	—
Nickel	14	0.001	< 0.0015	0.004	—	—	—
Nitrate	42	4.500	< 0.001	0.854	10	—	—
Nitrite	42	0.520	< 0.001	0.031	—	—	—
Oil and Grease	42	9.64	< 0.1	1.59	Virtually None	—	—
pH	42	9.3	5.1	7.15	6-8.5	4.5-9	—
Phenols	42	0.086	< 0.001	0.007	—	—	—
Phosphate	34	250	5.0	48.97	—	—	—
Phosphorus	34	200	5.0	43.97	—	—	—
Selenium	12	< 0.010	< 0.010	0.010	0.01	0.02	0.05
Silver	14	0.003	< 0.001	0.0007	0.05	—	—
Specific Conductance[1]	42	1.64	0.1	0.34	—	—	—
Sulfate	32	16	< 5.0	5.56	250	—	—
Sulfite	14	2.1	< 2.0	2.01	—	—	—
Temperature, °C	42	26.57	8.15	18.81	—	—	—
Total Dissolved Solids	42	217.1	< 1.0	83.40	500	3000	3000
Total Suspended Solids	42	187	< 1.0	24.92	—	—	—
Turbidity[2]	38	100	68	94.13	1.0T.U.	—	—
Vanadium	16	< 0.001	< 0.001	0.001	—	—	0.1
Zinc	14	0.280	0.003	0.066	5	—	25

Concentrations in mg/l, except where noted.

[1] Measured in mmho/cm.

[2] Measured in % Transmittance. 90% Transmittance = 5 Jackson Units. T. U. = Turbidity Unit.

Sources: U. S. Environmental Protection Agency; U.S. Department of Health, Education and Welfare; Southwest Research Institute, 1975.

TABLE 6-5

GROUND-WATER SAMPLES COLLECTED BY TUGCO

Sample Location	Date	Time	pH	Total Suspended Solids (mg/l)	Total Iron (mg/l)	Sulfates (mg/l)	Chlorides (mg/l)	TDS (mg/l)	Manganese (mg/l)	Selenium (mg/l)
Pump Well	4-9-80	1000	6.5	4	0.24	20	13	24	0.060	0.001
Test Pit	3-11-80	1130	4.3	65	0.98	26	15	14	0.015	--
USEPA Drinking Water Standards			6.5-8.5	—	0.30	250	250	500	0.050	0.010

Source: EH&A, 1981.

evolution of ground water moving through sediments from recharge areas to greater depths. Ground-water quality is generally good, as evidenced by the low total dissolved solids content.

6.3.1.4 Ground-water Use. Currently, ground water is being used for industrial, municipal, domestic and stock purposes. Most of the older wells are relatively shallow, hand-dug and tile-lined while the newer wells are relatively deep, drilled wells. Presently, all of the industrial and municipal wells and some of the domestic and stock wells are deeper, drilled wells. Two public water supply systems exit within the project area. The New Prospect Water Supply Cooperative serves about 413 customers and the Crims Chapel Water Supply Company serves about 196 customers. Each system relies on two wells completed in the deeper Wilcox sands (Fig. 6-7 and Appendix F). The trend in ground-water use is that the older shallow wells are gradually being abandoned in favor of deeper Wilcox wells which provide better quality and quantity of water. Thus, ground-water use is shifting away from use of the upper Wilcox to use of the deep Wilcox sands.

6.3.2 Impacts of No Action Alternative

The upper Wilcox sands found in this area would continue to provide water through shallow dug wells for domestic, stock and agricultural purposes. Ground water in the deeper Wilcox sands would serve as the major source of most domestic, industrial, and public supply systems. The trend toward greater use of the deeper Wilcox sands would continue.

6.3.3 Impacts of Project Alternatives

6.3.3.1 Mining Technology and Excavation. The water-bearing units to be affected are the Carrizo Formation and the channel sands and beds in the upper Wilcox Group. The properties of the pre-mine, shallow water-bearing units would be significantly altered, resulting in an irreversible impact. Mixing of discrete, clean sands which are interbedded with clays and silts would irreversibly alter the existing hydraulic properties of those units occurring in the project area. Deeper Wilcox sand bodies are separated from the lignite seam to be mined by intervening clay and lignite strata (see Figs. 6-3 and 6-4). Although some minor upward leakage may occur, no significant short-term or long-term adverse impacts would occur to these deeper sand bodies. As pointed out in Sec. 6.3.11, the intervening clays typically have permeabilities of less than 1 x 10^{-7} cm/sec. Since mining would not require depressurization of the deeper sands (because only minor leakage may occur), no reduction of water levels or pumping capacities in areas surrounding the mine would be anticipated.

The results of grain size analyses of overburden samples indicate that the overburden is 54.8 percent sand, 27.7 percent silt, and 19.5 percent clay. The following discussion applies to all four alternatives and the discussion of the impacts to surface infiltration is presented in Sec. 6.3.3.3. Permeabilities within water-bearing strata of the undisturbed Wilcox overburden range from 8 x 10^{-4} cm/sec to 1.6 x 10^{-2} cm/sec. Kennedy and Pepper (1980) examined the relationship of permeability versus depth for replaced Wilcox spoil materials having varying percentages of sand and claystone. These relationships indicate that permeability ranges from about 4 x 10^{-3} cm/sec at a depth of about 10 feet and decreases to between 1 x 10^{-4} cm/sec and 1 x 10^{-3} cm/sec below a depth of about 30 feet. The mixing of the overburden material would produce about equal horizontal and vertical permeabilities, but when comparing the spoil to undisturbed overburden where distinct beds of clay (low permeability) and sand (high permeability) existed, the result of mixing should be an overall higher vertical permeability and lower horizontal permeability. The permeability of the thicker sands would largely be unaffected and would probably range up to 1 x 10^{-2} cm/sec. Thus, mining would result only in minor, long-term adverse impacts to the hydrologic regime of the area after recharge was complete. Alternatives 2 and 4 would result in two layers (oxidized and unoxidized zones) with permeabilities reflecting the percentages of sand, silt and clay in those layers prior to mixing.

6.3.3.2 Dewatering. Certain areas northwest of Mill Creek may release enough ground water that a localized, dewatering system of wells would be employed to ensure highwall stability. The area where dewatering might be required comprises about 15 to 20 percent of the mine area. Water wells outside the active mine areas and completed above the lignite seam to the mined could be subject to a water-level drawdown of 0 to 150 feet; the greatest drawdown being determined by the maximum mining depth of 150 feet, assuming a completely saturated overburden.

To determine the radius of influence for pit dewatering under gravity flow conditions, the following formula (U. S. Dept. of Defense, 1971) was used:

$$R = C\,(H-h_w)\sqrt{k}$$

where,

R = the radius of influence.

$H-h_w$ = total drawdown. For the purposes of these calculations total saturation of overburden is assumed; therefore, H is equal to overburden thickness (or depth of mining) and h_w is assumed to equal 0.

k = coefficient of permeability (see Table 6-6).

C = 1.5 to 2.0 for a line sink (i.e., the pit face). 2.0 was used in the calculation to obtain a "worst case" result.

The analysis assumes an equal vertical and horizontal permeability throughout the overburden, examines a range of permeabilities, and is based upon the results of the on-site pumping test and published information (see Sec. 6.3.1.2). Mining depths were assumed to range from 20 to 150 feet. The results (Table 6-6) indicate that the maximum radius of influence (i.e., zero drawdown) would be on the order of 3,800 feet. These data were developed on a theoretical basis to determine the maximum extent of drawdown from the point of dewatering. The anticipated radius of influence from dewatering is expected to be less than 3,800 feet for the following reasons (see Figs. 6-3 and 6-4): (1) the overburden, as discussed earlier, is composed of alternating clay and sand strata and would not exhibit equal vertical and horizontal permeabilities throughout; (2) any given sand body does not necessarily maintain the same thickness throughout the area; and (3) no one sand body is as much as 150 ft thick.

The radius of influence from dewatering to water levels downdip from the project area (i.e., toward the northwest, see Fig. 6-2) cannot be readily determined. It is possible that during mining operations between State Highway 322 and Tiawichi Creek (see Fig. 5-3) when dewatering wells are operating, the radius of influence may extend a significant distance beyond the project boundary. It is recommended that, under these conditions, TUGCO monitor existing wells downdip from earlier mined areas to develop accurate predictions of effects from dewatering by pumping in the northwest area before mining in that area. This should coincide with the monitoring program required by the RRC.

Dewatering could dry or diminish the flow of any springs and seeps within the cone of depression created by dewatering in any given mine block, at any given time. The flow of

TABLE 6-6
PROJECTED RADIUS OF INFLUENCE (IN FEET) OF PIT DEWATERING BY GRAVITY FLOW

Head	Permeability[1] (cm/sec)			
	Carrizo		Wilcox	
(ft)	60×10^{-4}	120×10^{-4}	8×10^{-4}	160×10^{-4}
20	309	438	113	506
40			226	1,012
60			339	1,518
80			453	2,024
100			566	2,530
120			679	3,036
150			849	3,795

[1] Kennedy and Pepper, 1980.

springs and seeps outside the mine area, but within the cone of depression, should be re-established after resaturation of the spoil. Springs and seeps could be destroyed in the active mine area, but others could be created, after resaturation of the spoil, in areas where sand bodies outcrop on the side or toe of slopes.

Dewatering of the shallow Carrizo and Wilcox would create the potential for diverting flow from streams traversing the mine area. Table 6-7 shows mean flows calculated for streams in the project area. To assess the impacts of the dewatering operations on these streams, the following equation was used:

$$Q = \frac{KX}{2L} \ (H^2)$$

where:

Q = flow (cfs)
K = permeability (ft/sec)
X = length of stream along which flow occurs (ft)
L = distance from stream to highwall (ft)
H = head difference in water surface between stream and discharge face in highwall (ft).

Permeability was taken to be 46 ft/day (.0005 ft/sec) based upon the pumping test conducted by TUGCO although actual permeabilities of materials near streams should be less than one tenth of this figure. The distance (X) represents the distance along and parallel to the stream and highwall through which flow would occur and was assumed to be 5,000 ft. The distance (L) was varied depending upon the distance from the highwall to the stream. TUGCO (1982) stated that the highwall would never be closer than 500 ft to Mill Creek and usually no closer than 1,000 ft (also for Tiawichi Creek) while smaller streams could be approached to within 250 ft. These distances were based upon the location of the lignite. The head (H) is variable depending upon the stretch of stream under consideration and for these calculations was varied from 10 to 40 feet to allow for different sand thickness and heads along the individual streams in the mine area.

	Q (cfs)		
H (ft)	L = 250 ft	L = 500 ft	L = 1,000 ft
10	0.50	0.25	0.13
20	2.00	1.00	0.50
30	4.50	2.25	1.13
40	8.00	4.00	2.00

TABLE 6-7

CALCULATED MEAN FLOWS FOR STREAMS IN THE PROJECT AREA[1]

Stream	Drainage Area (mi^2)	Q_{mean} (cfs)
Tiawichi Creek	42	31.7
Mill Creek	42.9	39.5[2]
Todd Branch	2.1	2.2
Boggy Branch	3.1	3.2
Dry Creek	5.0	4.8
Dogwood Creek	2.8	2.9
Prospect Branch	1.8	2.0
Wright Branch	2.7	2.8

[1] Calculated from regionalized data using equation $Q_{mean} = 1.16\ (A)^{0.885}$, see Sec. 6.4.1.2.

[2] Q_{mean} based on two years actual streamflow data.

Therefore, these calculations when compared to streamflows in Table 6-7 indicate that portions of the upper tributaries in the project area could be dried up when the mine pit is close to a tributary. The major streams (Mill and Tiawichi creeks) should not be dried up during mean flow conditions. It is projected that no more than 10 percent of the flow in Mill Creek could be diverted to the mine pits based upon the head difference of 40 feet given above, the highwall within 500 feet and a mean flow 39.5 cfs. Mitigation to this impact is that water collected in the pit would be pumped out and returned to the stream via sedimentation ponds so that downstream flows would not be adversely affected.

6.3.3.3 Reclamation. During mining, dewatering would cause ground water to flow towards the open pit, thus confining ground water to the project site. Once mining and dewatering were completed, the spoil would be subject to resaturation. There are three potential sources of water for resaturation of the mine: (1) infiltration of precipitation; (2) upward leakage from sand bodies beneath the mine; and (3) inflow from sand bodies adjacent to the mine.

Post-mine recharge from precipitation might be slightly reduced regardless of the overburden handling alternative used since the overall permeability of the replaced overburden would be less than that of the pre-mine overburden. Alternatives 3 and 4 (those with topsoil replacement) would cause a greater reduction (than 1 or 2) in infiltration rates if the A, B and C horizons were used. If only the A horizon were used, surface infiltration would be increased to approximately the present level. However, below about 15 inches (A horizon thickness) the infiltration rate would be reduced. Revegetation would minimize the reduction of the infiltration rates. No site-specific water balance data for the site are available; however, it is estimated that about 8 inches per year could be expected to recharge the overburden. Assuming no other sources of recharge, a porosity of 20 percent, and an average overburden thickness of 80 feet, it would take about 23 years to resaturate.

Recharge from below the mine would be minimal, since the mine is underlain by clay and lignite strata (Figs. 6-3 and 6-4) with low permeabilities.

Recharge from adjacent sand bodies was evaluated using the Darcy equation as follows:

$$v = \frac{ki}{n} \quad \text{(Cedergren, 1967)}$$

where:

v = velocity, in ft/day;

k = expected permeability (ft/day) of lower overburden = 5.0 x 10^{-4}; cm/sec (517 ft/yr) (Table 6-3);

i = hydraulic gradient = 60 ft per 929 ft;

n = effective porosity (20% assumed but could be as much as 30%).

The resulting horizontal velocity equals 167 ft/yr. The actual rate might be lower due to capillary pressure heads in the unsaturated overburden. The average radius from the edge of a mine block to the center of the block would be approximately 3,000 ft and 15 to 18 years would be required for ground water to move across a mine block. Therefore, it appears that the amount of time to resaturate should be on the order of 10 to 23 years, considering both sources of recharge to the spoil.

A major concern for the successful reclamation of mined land is the potential for the release of chemical constituents from the overburden into the surface soil layer, the surface water or the ground water. The results of the geochemical analyses from the overburden cores (Sec. 6.1.1 and Appendix D) indicate that no significant problems should result from any of the chemical constituents. The concentrations of all constituents appear to be within normal ranges for soil (Gough et al., 1979) and should allow successful reclamation. Some layers of the overburden contain concentrations of certain constituents (e.g., pyrites) which may cause short-term adverse impacts to the surface layer and/or surface water. Reclamation procedures (Sec. 6.2.3.5) are designed to identify and minimize these impacts. Overburden that lies below the existing water table exists under anaerobic (chemically reducing) conditions. Once the water table was lowered by dewatering, and the overburden excavated and replaced, the material would be exposed to the atmosphere and oxidizing conditions. These conditions could allow the release of certain constituents into the ground water. The constituents of greatest concern are sulfate, iron and total dissolved solids. Based upon the geochemical analyses, it is projected that sulfate and total dissolved solids concentrations in post-mine ground water would average about 600 and 1,000 mg/liter, respectively. These projected levels are about 100 times the existing concentrations and 2.5 times the drinking water standards for sulfates and 12 times existing concentrations and 2 times drinking water standards for dissolved solids. The significance of impacts from these and other constituents on ground water quality is discussed below. Impacts to surface water quality are discussed in Sec. 6.4.3.4. No specific projections are made for iron. These constituents pose no significant health problems although sulfate tends to act as a laxative to people not accustomed to water high in sulfate, total dissolved solids is associated with taste preferences, and iron tends to stain clothing and plumbing fixtures. Other less common elements, such as the heavy metals, might become mobilized if the pH of the overburden were lowered to 4.0 or less, through oxidation of iron disulfides. Even though the pH at several locations within the overburden is reported to be less than 4, calculations indicate that once the spoil was replaced, a pH value greater than 4 would exist. Reclamation procedures also call for the addition of lime to control soil pH. Therefore, potential for leaching of heavy metals should be reduced.

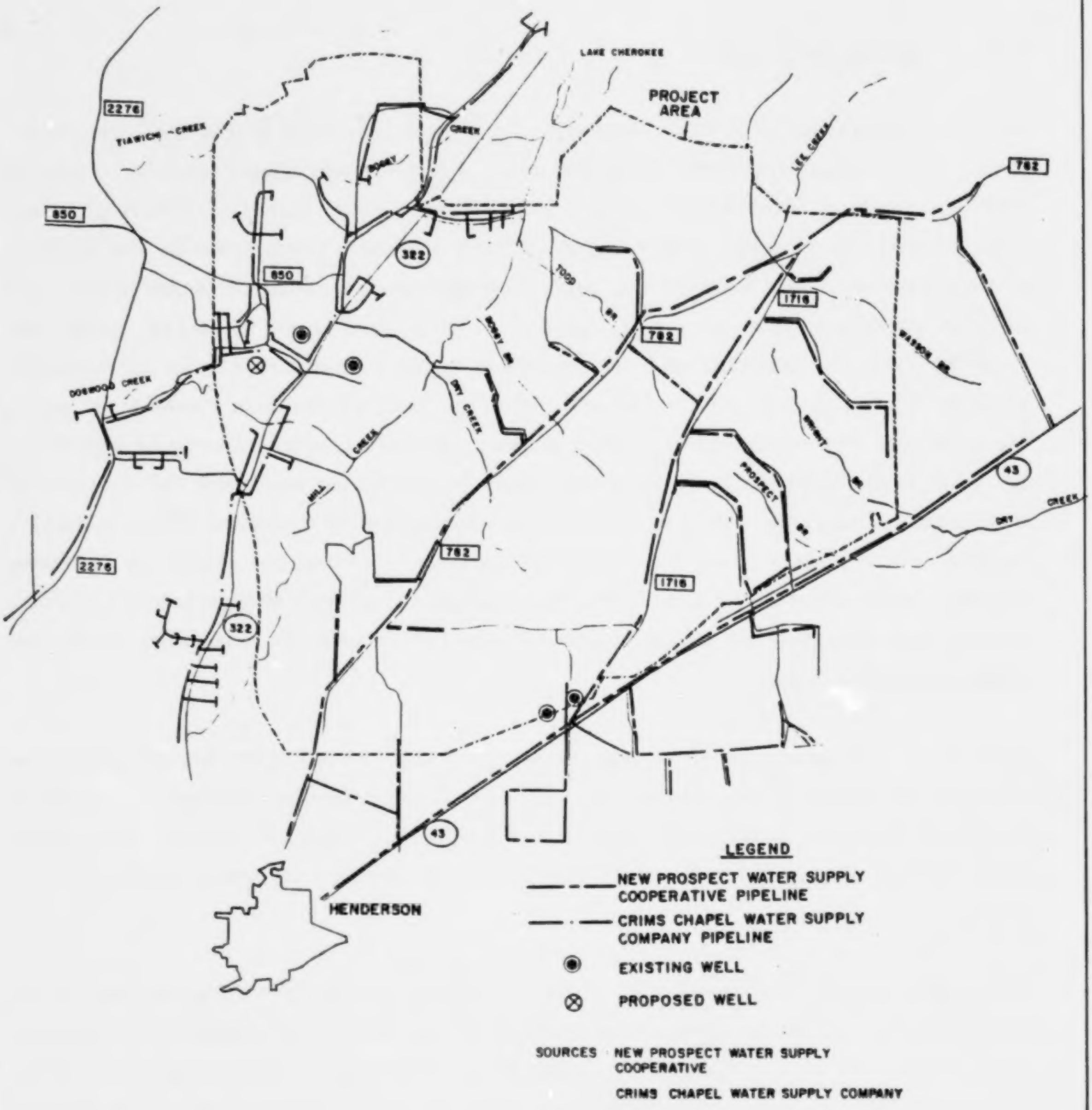
Once the water table was re-established, any leachate previously formed would have the potential to flow from the mine to adjacent, down-gradient (i.e., northwest), water-bearing sands. As previously mentioned, the horizontal permeability of spoil would be lower than undisturbed overburden. Consequently, the quantity of flow from the spoil to adjacent ground-water bodies should also be reduced.

Typically, peak leachate concentrations are found in the first pore volume of (the volume representing the space between individual sand, silt or clay particles) water contained in leachate generating materials. Subsequent pore volumes generally have lower concentrations. Therefore, the maximum potential effect would exist during the time period when the first pore volume was migrating from the mined area. The length of the time period would be dependent upon the permeability, porosity and the hydraulic gradient in the overburden. General conclusions based on these parameters indicate that any leachate would move slowly from the area and would take several years to be completely flushed from the system. Therefore, any plume of leachate should attain a steady-state condition. Based upon dispersion modeling studies, it is probable that the edge of any steady-state plume down-gradient of the mine would be within 2,500 feet of the mine area.

The leachate concentrations in any plume would be reduced with distance from the mine area. The concentrations of dissolved constituents down-gradient of the mine would be primarily dependent upon the ambient ground-water velocity, physical processes of mechanical dispersion, and dilution by infiltrating precipitation. It is anticipated that concentrations exceeding water quality standards would be restricted to within a few hundred feet downgradient (i.e., northwest) of the mine. Therefore, ground-water contamination should not be a significant problem at the site and there should not be a significant long-term adverse impact to the ground-water quality. Monitoring wells would be installed by the applicant to assess the extent of migration of any leachate based upon a program developed by the RRC. It would be desirable for TDWR, if it has not already done so, to include wells from the northwest (downdip) of the project area in its statewide monitoring system.

The conclusions that the chemical constituents from "D" Area overburden would not cause significant impacts to the surface layer, surface water or ground water are further strengthened by comparison to the "A," "B" and "C" areas. Although the concentrations of individual constituents vary between the different overburdens, they are within the same general ranges. TUGCO is monitoring ground-water quality in the "A," "B" and "C" areas under a program developed by the RRC. Data from these monitoring wells (Appendix G) show that there has been no contamination of the ground-water system at these existing mines.

6.3.3.4 Ground-water Supply. Some of the 142 wells in the mine area would be eliminated and other wells could be indirectly affected. Eliminated wells could be replaced after mining by completing them in the deeper Wilcox sands resulting in a short-term impact to users. Wells eliminated by mining would be compensated for under terms of the lease agreement like any other surface improvement. Wells indirectly affected by mining or mine-related operations would be replaced or compensated for according to RRC regulations. The impact to ground-water production in the units above the mined lignite is considered a significant and long-term adverse impact but, overall, not irreversible. Any interruption of service to approximately 600 customers served by the New Prospect Water Supply Cooperative and Crims Chapel Water Supply Company (Fig. 6-9) would be compensated for in accordance with RRC regulations and/or lease agreements. The four wells presently used by these utilities are completed, at depths ranging from 634 to 788 feet, in the deeper Wilcox sands. The 484 feet of material between the deepest point of mining (150 feet) and the shallowest utility well (634 feet) are composed of alternating strata of sand, clay and lignite (Figs. 6-3 and 6-4). These deeper clays in the Wilcox Formation typically have permeabilities of less than 1×10^{-7} cm/sec (Mathewson et al., 1982). Thus, these wells would not be adversely affected by dewatering for mining and would not be physically affected by mining activities (TUGCO, 1982).



TEXAS UTILITIES GENERATING CO.
MARTIN LAKE "D" AREA

Fig. 6-9

PUBLIC WATER SUPPLY SYSTEMS

6.4 SURFACE-WATER RESOURCES

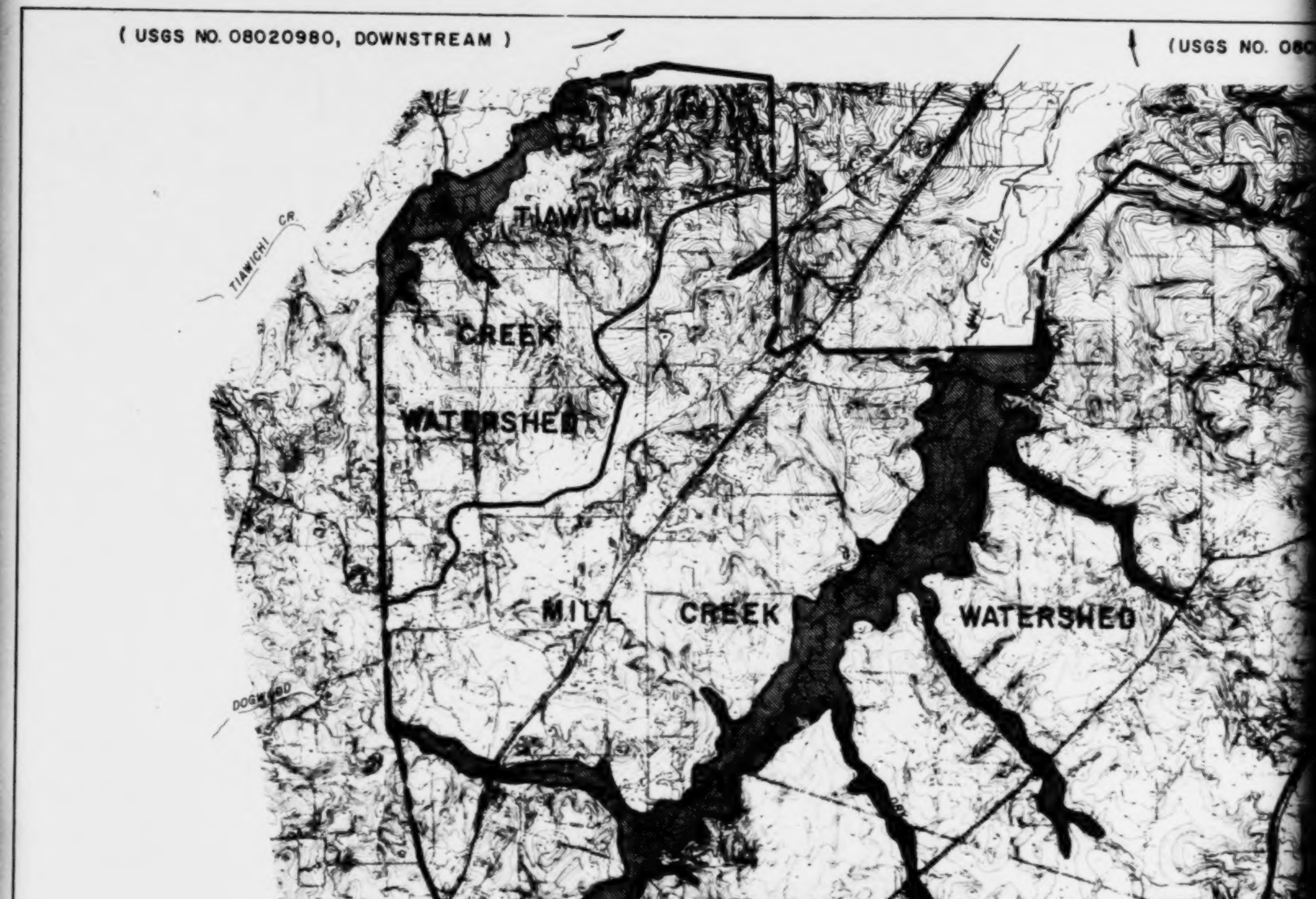
6.4.1 Existing Environment

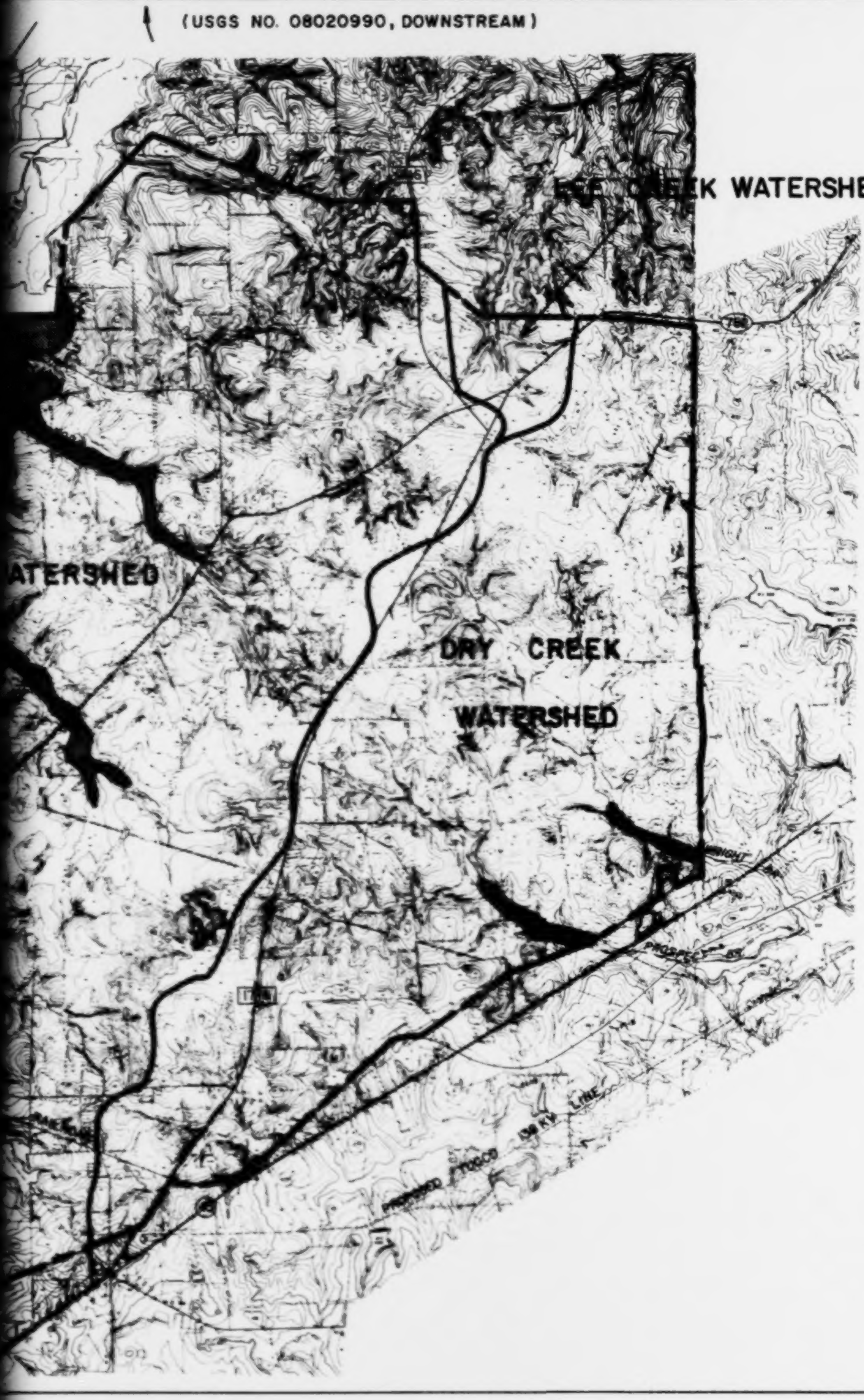
6.4.1.1 General Information. The proposed project is located within the Sabine River Basin. The largest portion of the project area (approximately 69 percent) is drained by Mill Creek, which traverses the project area, flowing in a northeasterly direction into Lake Cherokee on Cherokee Bayou, approximately 2.2 miles downstream of the northern project boundary. Mill Creek has a total drainage area of about 45 square miles. The extreme northwestern corner of the project area (8 percent of the total) drains into Tiawichi Creek, a tributary of Lake Cherokee which forms part of the northwestern boundary of the project area. The total drainage area of Tiawichi Creek is about 60 square miles. The southeastern portion of the project area, approximately 20 percent of the total, is drained by tributaries of Dry Creek (not to be confused with the tributary to Mill Creek of the same name), which flows in a southeasterly direction. The remaining 3 percent of the project area, located in the extreme northeastern corner of the area, contains the headwaters of Lee Creek, another Lake Cherokee tributary which drains a total of approximately 15 square miles. Figure 6-10 shows the watershed boundaries within the project area.

Several local streams originate within the project area. These streams include tributaries of Mill Creek (Boggy Creek, Dry Creek, Todd Branch and Boggy Branch) and tributaries of Dry Creek (Prospect Branch and Wright Branch). The headwaters of Adaway Creek, which flows into Mill Creek within the project area, lie just outside the project boundary to the south.

The project area is characterized by a humid subtropical climate, with an average of 243 frost-free days per year, typically extending from March 17 to November 15. Temperatures average 48 degrees Fahrenheit in winter, 65 in spring, 82 in summer, and 66 in fall (EH&A, 1981b). Average annual rainfall for the area is approximately 46 inches, ranging from 23.2 inches in 1963 to 67.8 inches in 1957. Summer is typically the driest season of the year, and spring is usually the wettest; monthly rainfall averages range from a low of 2.79 inches in August to a high of 4.82 inches in May (TNRIS, 1981).

Net annual lake evaporation in the project area for the period 1940-1979 averaged 1.62 feet, varying from a minimum of -1.08 feet in 1957 to a maximum of 2.70 feet in 1978.


(USGS NO. 08020980, DOWNSTREAM)
(USGS NO. 080
TIAWICHI
CREEK
WATERSHED
TIAWICHI CR.
MILL CREEK WATERSHED
DOGWOOD



▇ FLOOD PLAIN

▼ STREAMFLOW GAGE
USGS NO. 08020960

Source: Federal Insurance
Administration, 1977

DATE OF PHOTOGRAPHY: FEB 1980

TEXAS UTILITIES GENERATING CO.
MARTIN LAKE "D" AREA

Fig. 6-10

APPROXIMATE 100 YEAR FLOOD
PLAIN & WATERSHED DIVIDES

Average monthly net evaporation varies from approximately -0.1 feet in January to 0.4 feet in August (TNRIS, 1981). The aforementioned data are for a quadrangle covering the area from latitude 32° to 33° and longitude 94° to 95°, and are based on a network of Class A pan evaporation gages (Texas Water Development Board, 1967). The low evaporation rate for Rusk County is characteristic of the wet, humid climate of the area.

6.4.1.2 Hydrologic Characteristics.

Local Runoff Potential. Some knowledge of the hydrologic characteristics of the project area can be gained through examination of runoff potential of the various soil-cover complexes on the site. Soil types are categorized by the SCS based on runoff potential. Hydrologic Group A has the lowest runoff potential (highest infiltration capacity) followed by Groups B, C and D. The hydrologic classification of each soil association found in the project area was determined from the SCS soil list (SCS, 1972) after an interpretation of the general soils map of Rusk County (SCS, 1974).

The Kirvin-Bowie-Cuthbert soil association has an overall Hydrologic Group Classification of C. It consists of gently sloping to moderately steep soils which are moderately to slowly permeable. Consisting chiefly of sandy loam soils over clay or clay loam subsoils, this association has a fairly high runoff potential. It comprises about 64 percent of the project area.

The Nacogdoches-Trawick soil association has a hydrologic classification of B. It contains gently sloping to moderately steep, moderately slowly permeable soils. Most soils in this association are characterized by a thin, fine sandy loam surface layer over clay subsoils. Runoff potential is moderate. This association makes up approximately 16 percent of the project area.

About 10 percent of the project area is made up of soils in the Lilbert-Tenaha association. These gently sloping to moderately steep, moderately permeable soils consist chiefly of a loamy fine sand surface overlying clay loam subsoils. With a Hydrologic Group Classification of B, the runoff potential of this association is relatively low.

Soils of the Nahatchie-Mantachie association are found along Mill Creek and Tiawichi Creek in the project area. Making up about 10 percent of the total project area, these nearly level flood plain soils consist of moderately to very slowly permeable clay loam surface layers and subsoils. The Hydrologic Group Classification for this association is C, denoting a moderately high runoff potential.

Streamflow Records. Three recording streamflow gages have recently been installed in the immediate project vicinity. One of these gages (USGS No. 08020960), located on Mill Creek within the project boundaries, has been in operation since October 1978. USGS No. 0820980 is located on Mill Creek a short distance downstream of the project area and has also been in operation since October 1978. USGS No. 0820990, located on Tiawichi Creek immediately downstream of the project boundary, has been in operation since November 1977. The location of USGS No. 08020960 with respect to the project area is shown in Fig. 6-10 but the area covered by the map does not include the other two gages. Streamflow records for Mill Creek at the gages near Henderson and Longview and Tiawichi Creek near Longview during the two-year period extending from October 1978 through September 1980 indicate mean discharges at the three gages of 17.7, 39.5 and 69.8 cfs, respectively. Corresponding drainage areas for these three gages are 20.3, 47.9 and 62.7 square miles, respectively (USGS, 1980; 1981).

Because of the short periods of record for the three recently-installed gages in the immediate project area, their records are insufficient for use in an analysis of long-term streamflow characteristics of the region. However, streamflow records of longer period are available for several other watersheds in the general area of the project and are deemed suitable for use as prototypes to determine some of the general hydrologic characteristics of the region. Records for additional gaged streams in the area were not used in the regional hydrologic studies due to such factors as upstream regulations, diversions and return flows.

Mean daily discharges for the selected gaged streams in the project vicinity are presented in Table 6-7. Figure 6-11 is a plot of mean daily discharge versus drainage area based upon the data in Table 6-7, and is a graphical representation of the following equation:

$$Q_{mean} = 1.16 \ (A)^{0.885}$$

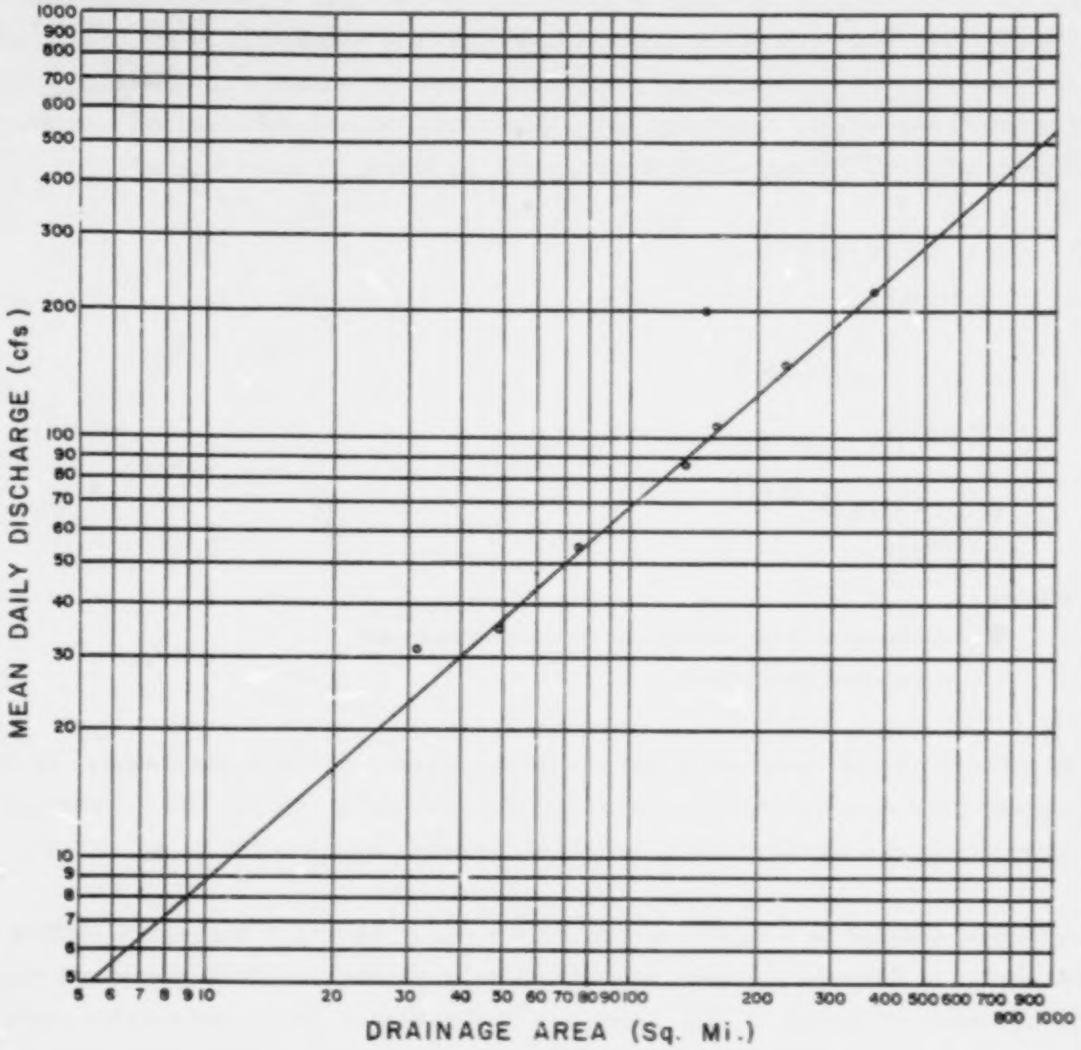
where:

Q_{mean} = mean daily discharge in cfs;

A = drainage area of stream in square miles; and

1.16 and 0.885 are regression constants.

This equation, derived by a linear regression analysis of the data in Table 6-7 (data for Striker Creek and Bayou La Nana omitted due to poor correlation), may be used to estimate the mean daily discharge of project-area streams based on drainage area.



Texas Utilities Generating Co.
Martin Lake "D" Area

Fig. 6-11
MEAN DISCHARGE vs.
DRAINAGE AREA

Flow-duration data for the gaged streams in the project area are presented in Table 6-8. Relationships between drainage area and flow equaled or exceeded 2, 10 and 25 percent of the time ($Q_{2\%}$, $Q_{10\%}$ and $Q_{25\%}$, respectively) were determined empirically using linear regression techniques. Relationships for lower flows were not derived because of poor data correlation. The relationships for $Q_{2\%}$, $Q_{10\%}$ and $Q_{25\%}$ are as follows:

$Q_{2\%} = 6.09\ (A)^{0.957}$
$r = 0.9922$

$Q_{10\%} = 1.75\ (A)^{0.980}$
$r = 0.9902$

$Q_{25\%} = 1.21\ (A)^{0.867}$
$r = 0.9802$

where:

A = drainage area of the stream in square miles; and
r = correlation coefficient.

In addition to the previously-noted streamflow gages, the USGS maintains a reservoir content gage on Lake Cherokee, immediately north of the project site. Instantaneous observations of reservoir capacity have been recorded daily since 1951.

Low flow and high flow frequency data for the selected gages in the project vicinity are presented in Table 6-9. These data were developed from records of lowest and highest mean daily discharges at the gages for a duration of seven consecutive days, as determined from USGS measurements for the periods of record (USGS, 1981). The 2-year, 7-day low flow value is of regulatory significance because the Texas Department of Water Resources' criteria for dissolved oxygen and temperature apply only when the mean daily discharge equals or exceeds the 2-year, 7-day minimum average flow (TDWR, 1981).

6.4.1.3 Water Quality. Water quality data for streams in the vicinity of the project area have been collected by several entities, including the USGS, TWQB (now a part of the TDWR), SWRI and the Sabine River Authority of Texas (SRA). The USGS monitors the water quality of the Sabine River near Beckville, downstream of the mouth of Cherokee Bayou. Chemical, biochemical and pesticide analyses at this station were initiated in February 1952, January 1968, and March 1968, respectively. Table 6-10 presents selected

TABLE 6-8

FLOW DURATION DATA FOR GAGED STREAMS IN THE PROJECT VICINITY

Gage	USGS No.	Drainage Area (mi^2)	$Q_{2\%}$		$Q_{10\%}$		$Q_{25\%}$		$Q_{50\%}$		$Q_{75\%}$		$Q_{95\%}$	
			(cfs)	(csm)[1]	(cfs)	(csm)[1]	(cfs)	(csm)[1]	(cfs)	(csm)[1]	(cfs)	(csm)[1]	(cfs)	(csm)[1]
Prairie Creek near Gladewater	08020200	48.9	233	4.76	78.0	1.60	41.0	0.838	18.0	0.368	3.7	0.076	0.1	.002
Rabbit Creek at Kilgore	08020700	75.8	408	5.38	99.0	1.31	49.0	0.646	19.0	0.251	4.9	0.065	0.2	.003
Murvaul Bayou near Gary	08022300	134	715	5.34	240	1.79	74.0	0.552	16.0	0.119	1.9	0.014	0.0	0.0
Kickapoo Creek near Brownsboro	08031200	232	970	4.18	340	1.47	110	0.474	320.0	0.138	3.1	0.013	0.0	0.0
East Fork Angelina River near Cushing	08033900	158	815	5.16	240	1.52	100	0.633	41.0	0.259	16.0	0.101	5.1	0.032
Mud Creek near Jacksonville	08034500	376	1,820	4.84	640	1.70	260	0.691	75.0	0.199	20.0	0.053	0.9	0.002
Bayou La Nana at Nacogdoches	08037050	313	268	8.56	58.0	1.85	24.0	0.767	5.2	0.166	0.5	0.016	0.0	0.00

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[1] csm = cubic feet per second per square mile of drainage area.

Source: USGS, 1981.

TABLE 6-9
LOW AND HIGH FLOW FREQUENCY DATA FOR GAGED STREAMS IN PROJECT VICINITY

Gage name	USGS Station No.	Drainage (mi^2)	Period of Record	7-day low flows[1]				7-day high flows[1]			
				2-year		10-year		2-year		10-year	
				(cfs)	(csm)[2]	(cfs)	(csm)[2]	(cfs)	(csm)	(cfs)	(csm)
Prairie Creek near Gladewater	08020200	48.9	1969-1976	0.367	7.51	0.025	0.511	189	3.87	400	8.18
Rabbit Creek at Kilgore	08020700	75.8	1965-1976	0.583	7.69	0.152	2.01	401	5.29	1,220	16.1
Murvaul Bayou near Gary	08022300	134	1959-1979	2.05	23.0	0.148	1.10	657	4.90	1,840	13.7
Kickapoo Creek near Brownsboro	08031200	232	1963-1979	0.196	0.845	0.069	0.297	1,490	6.42	3,610	15.6
East Fork Angelina River near Cushing	08033900	158	1965-1979	5.01	31.7	1.58	10.0	861	5.45	2,110	13.4
Mud Creek near Jacksonville	08034500	376	1949-1979	3.42	9.10	0.255	0.678	2,000	5.32	5,410	14.4
Bayou La Nana at Nacogdoches	08037050	31.3	1966-1980	0.182	5.81	0.026	0.831	206	6.58	795	25.4

[1] Mean daily discharge for seven consecutive days.

[2] In thousandths.

Source: USGS, 1981.

TABLE 6-10

WATER QUALITY DATA AND STREAM STANDARDS
SABINE RIVER NEAR BECKVILLE, TEXAS
(USGS No. 08022040)
1975-1979

Parameter	Units	Mean	Maximum	Minimum	TDWR Standards[1]
Chlorides	mg/L	40	260	17	Not to exceed 175
Sulfates	mg/L	23	130	15	Not to exceed 75
Total Dissolved Solids	mg/L	138	562	72	Not to exceed 400
Dissolved Oxygen	mg/L	7.8	11.6	4.9	Not less than 5.0
pH	standard units	6.9	7.7	5.5	6.0-8.5
Temperature	°F	68	97	36	Not to exceed 93
Fecal Coliform[2]	#/100mL	—	—	—	Geometric mean not to exceed 2,000

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[1] TDWR water quality standards for Sabine River Segment 0505 (Sabine River from U.S. Highway 271 near Gladewater to headwaters of Toledo Bend Reservoir).

[2] Fecal coliform data not available.

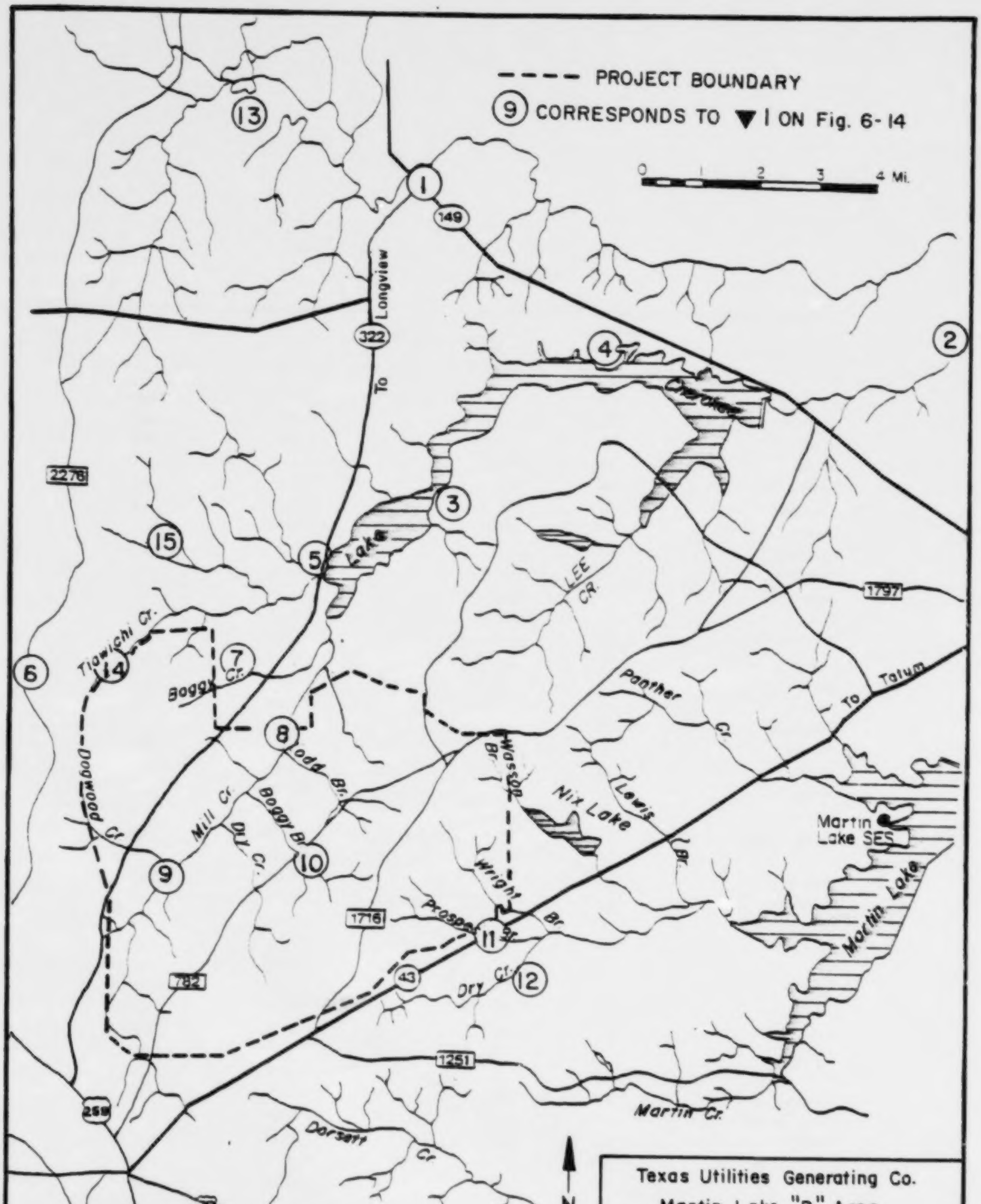
Source: TDWR, 1981; USGS, 1976-1980.

water quality data for the Sabine River near Beckville for water years 1975-1979. Pertinent TDWR water quality standards for Sabine River Segment 0505, the Sabine River from U.S. Highway 271 near Gladewater to the headwaters of Toledo Bend Reservoir, are included (TDWR, 1981). The reported averages were well within the state standards for the parameters noted, although standards were exceeded occasionally.

SWRI implemented a year-long water quality sampling and analysis program in the project area in 1974. The location of the water quality sampling stations are shown in Fig. 6-12. Four stations are located within the 30-year mine boundary, and several of the others are located downstream of the 30-year mine area. A summary of results from the sampling program is presented in Table 6-11. All but eight of the 37 parameters measured met the most stringent water quality standards set by the U.S. Environmental Protection Agency, U. S. Public Health Service, and the TDWR for drinking, aquatic life, irrigation, livestock and recreational uses (SWRI, 1975).

Based upon the water quality data collected during the SWRI sampling program, ammonia was found to exceed EPA water quality standards for aquatic life, but was generally within the standards for other uses. Mercury concentrations exceeded drinking water standards at all sampling locations at some time during the program. Phenols, which are often found in areas of oil and chemical-related activities, were in excess of standards in almost 25 percent of the samples taken. Alkalinity, pH, dissolved solids, suspended solids and turbidity were found to exceed standards in a significant number of the samples but were generally representative of results from other streams in east and central Texas.

SWRI compared water quality data for the Sabine River (monitoring station No. 1) with data from two stations on Lake Cherokee and one station on Cherokee Bayou (station Nos. 3, 4 and 8, Fig. 6-12). The parameters chosen for the comparsion were those normally collected by the TWQB (now TDWR) which monitors the Sabine River and Lake Cherokee in connection with its Statewide Monitoring Network. The results of the comparison, presented in Table 6-12, indicated that fecal coliform levels in the Sabine River were much higher than in Cherokee Bayou or Lake Cherokee. Additionally, concentrations of dissolved constituents and nutrients in the Sabine River were somewhat higher than in Cherokee Bayou and Lake Cherokee. Fecal coliform was the only parameter with levels in excess of the state water quality standards at any of the four monitoring sites.



Texas Utilities Generating Co.
Martin Lake "D" Area

Fig. 6-12
SWRI
SURFACE WATER
SAMPLING SITES

SOURCE: SWRI, 1975.

TABLE 6-11
SUMMARY OF SURFACE-WATER QUALITY DATA
SWRI MONITORING PROGRAM (1975)

Parameter	Number of Samples	Samples Maximum	Samples Minimum	Samples Mean	Units
Alkalinity	136	46.8	< 1.0	< 10.14	mg/L
Ammonia	136	0.64	< 0.05	< 0.16	mg/L
Arsenic	45	49.0	< 5.0	< 9.6	μg/L
Barium	35	< 200	< 200	< 200	μg/L
Boron	136	1,100	< 100	< 201.46	μg/L
Cadmium	126	3.2	< 0.5	< 0.70	μg/L
Chlorides	136	399	< 0.4	< 39.19	mg/L
Chlorine	125	0.2	< 0.2	< 0.2	mg/L
Chromium	46	1.4	< 0.5	< 0.54	μg/L
Copper	46	1,167	< 0.3	< 54.59	μg/L
Cyanide	135	215	< 1.0	< 9.02	μg/L
Dissolved Oxygen	136	10.6	2.1	7.63	mg/L
Fluoride	32	0.74	< 0.1	< 0.18	mg/L
Iron	126	600	< 1.0	< 45.75	μg/L
Lead	46	11.0	< 1.0	< 2.45	μg/L
Manganese	126	28.0	< 0.3	< 2.38	μg/L
Mercury	126	861	< 0.5	< 9.96	μg/L
Nickel	46	32	< 1.5	< 6.59	μg/L
Nitrate	136	932	< 100	< 206.89	μg/L
Nitrite	136	164	< 1.0	< 8.52	μg/L
Oil and Grease	136	5.82	< 0.1	< 0.57	mg/L
pH	136	9.6	5.2	7.01	---
Phenols	136	60	< 1.0	< 8.36	μg/L
Phosphate	112	650	< 5.0	< 57.46	mg/L
Phosphorous	112	550	< 5.0	< 30.31	μg/L
Selenium	35	< 10	< 10	< 10	μg/L
Silver	46	7.3	< 0.1	< 1.05	μg/L
Specific Conductance	136	2.75	< 0.10	< 0.29	mmho/cm
Streamflow	117	300	< 1.0	< 93.47	ft/min
Sulfates	102	48	< 5.0	< 11.79	mg/L
Sulfite	46	9	< 2.0	< 2.25	mg/L
Temperature	136	30.6	5.7	17.18	°C
Dissolved Solids	136	1,905	< 1.0	< 167.73	mg/L
Suspended Solids	136	443.6	< 1.0	< 56.88	mg/L
Turbidity	125	100	1	56.18	Percent Trans.
Vanadium	69	< 10	< 10	< 10	μg/L
Zinc	46	622	< 1.0	< 42.67	μg/L

Source: SWRI, 1975.

TABLE 6-12

COMPARISON OF WATER QUALITY AT SELECTED SAMPLING SITES ON SABINE RIVER, LAKE CHEROKEE AND CHEROKEE BAYOU

(12-month period during 1974 and 1975)

Parameter	Units	Sampling Site No. 1 (Sabine River)			Sampling Site No. 3 (Lake Cherokee)			Sampling Site No. 4 (Lake Cherokee)			Sampling Site No. 8 (Cherokee Bayou)		
		Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
Ammonia	mg/L	0.55	< 0.05	0.18	0.36	< 0.05	0.13	0.36	< 0.05	0.15	0.46	< 0.05	0.15
Chlorides	mg/L	81.8	1.4	45.4	42.7	0.8	29.21	40.0	0.6	26.5	22.5	0.4	13.5
Conductivity	mmho/cm	0.52	< 0.1	0.28	1.34	< 0.1	0.26	1.22	< 0.1	0.27	1.23	< 0.1	0.24
Dissolved Oxygen	mg/L	10.6	4.0	7.53	9.8	3.8	7.89	9.5	5.6	7.93	9.7	5.5	7.73
Fecal Coliforms	#/100mL	30,000	56	4,540	530	< 1	93	380	3	42	8,000	< 1	1,016
Nitrates	µ g/L	580	< 100	287.5	183	< 100	113.17	150	< 100	104.5	932	< 100	236.75
pH	standard units	9.6	6.4	7.48	8.4	6.2	7.19	9.6	6.4	7.42	7.6	6.3	6.83
Phosphates	µ g/L	650	< 5.0	163	300	< 5	55	50	< 5	18.5	150	< 5	37.5
Sulfates	mg/L	48	10	25.89	20	< 5.0	10.44	10	< 5.0	7.11	48.0	< 5.0	19.71
Suspended Solids	mg/L	67.9	16	43.18	120	< 1.0	34.27	200	< 1.0	51.43	182	< 1.0	61.33

Source: SWRI, 1975.

The SRA's water-quality monitoring program, conducted in accordance with the Texas Water Rights Commission-approved Reservoir Operations Plan for the previously-proposed cooling reservoir on Mill Creek, involved weekly and monthly sampling at five locations (Fig. 6-13). Site 1 for the SRA program corresonds to Site 9 for the SWRI program. The parameters analyzed and frequency of collection under the SRA monitoring program were tabulated previously (EH&A, 1981). Water-quality data from the SRA monitoring program, collected during the four-year period 1977 through 1980, are presented in Table 6-13 for several water quality parameters, including those for which the TDWR has set numerical standards. On the average, most of the parameters remained within the standards, with levels similar to those noted in the SWRI study, although increases were noted in average concentrations of dissolved constituents. Somewhat lower pH values were also observed. Chloride and total dissolved solids concentrations at the upper sampling location on Mill Creek (Site 1) were considerably higher than those observed at the other four sites.

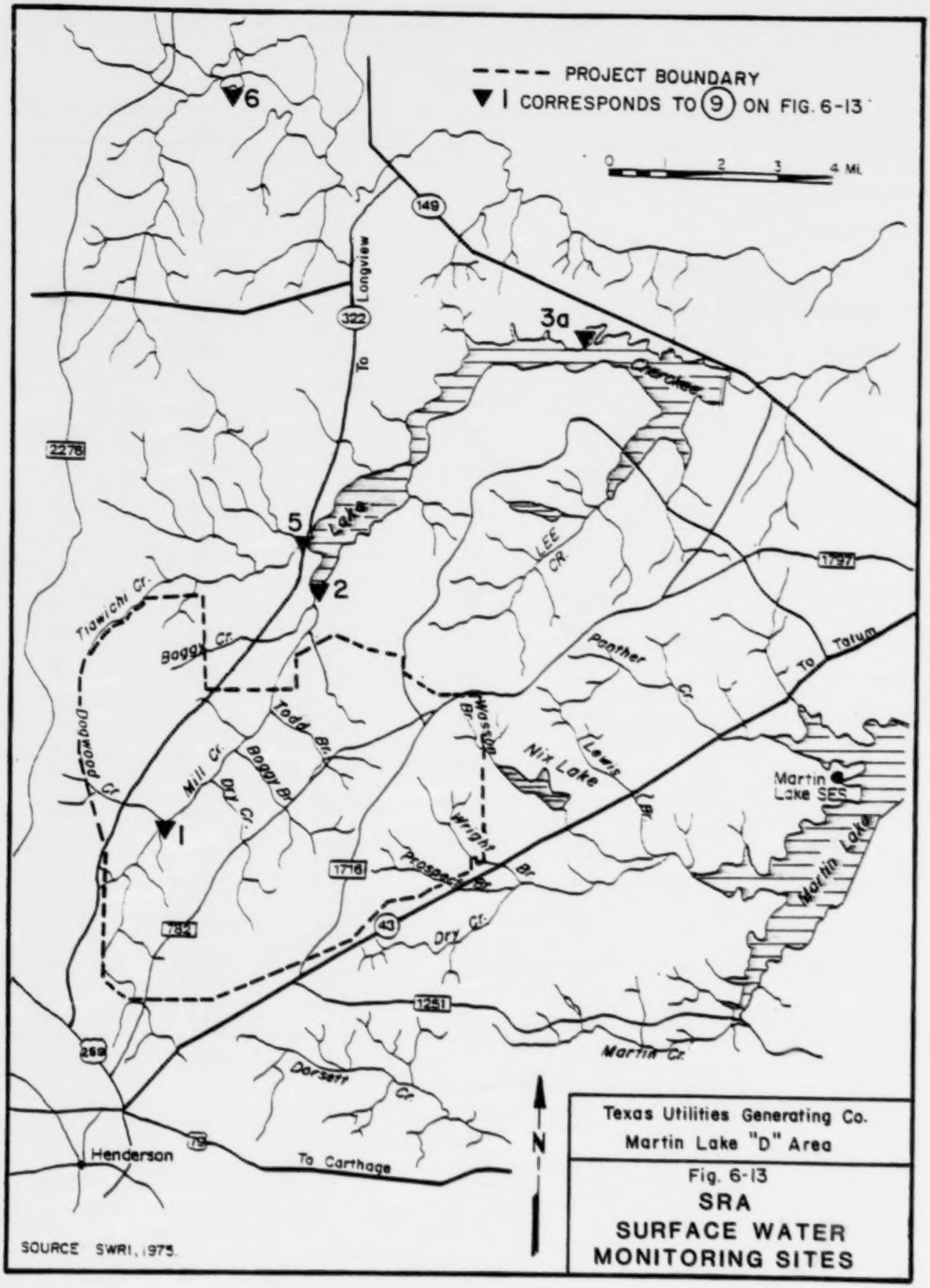
6.4.2 Impacts of No Action Alternative

If the "no action" alternative is implemented, the surface water regime of the project area should remain essentially unchanged from existing conditions, barring the possibility that other independent development may occur in the vicinity. Storm runoff, flow-duration, low flow and water quality characteristics would not experience the alterations typically associated with surface mining, and mitigative measures would not be necessary.

6.4.3 Impacts of Project Alternatives

Activities related to mining and reclamation of the Martin Lake "D" Area would result in some short-term adverse impacts to the hydrologic regime of the Cherokee Bayou watershed. However, these short-term impacts should be minor as a result of the relatively small area of the watershed to be disturbed at any particular time. Major long-term adverse impacts are not anticipated due to mitigative measures undertaken in compliance with federal and state regulations and plans to reclaim the area to conditions very similar to those which presently exist.

The overall surface water impacts of mining and reclamation of the Martin Lake "D" Area would be, to a degree, dependent upon the overburden handling alternative selected. As noted in Sec. 5.1.5, the alternative overburden handling techniques considered include: (1)



Texas Utilities Generating Co.
Martin Lake "D" Area

Fig. 6-13
SRA
SURFACE WATER
MONITORING SITES

SOURCE SWRI, 1975.

TABLE 6-13
WATER QUALITY DATA - EXTREMES AND MEANS SABINE RIVER AUTHORITY MONITORING PROGRAM 1977 - 1980

Parameter	Units	Site 1 (Mill Creek)	Site 2 (Mill Creek)	Site 3a (Lake Cherokee)	Site 5 (Tiawichi Creek)	Site 6 (Sabine River)
Temperature	°F	33-87[a] 63[b]	34-85 63	36-94 68	32-87 61	34-90 63
Dissolved Oxygen	mg/L	4.6-14.1 8.2	3.3-12.6 7.4	6.3-13.0 9.2	4.1-13.6 7.9	5.3-13.6 8.5
pH	Standard Units	5.3-7.2 6.6	4.3-7.2 6.5	6.5-7.9 7.0	3.3-7.3 6.3	5.6-7.7 6.9
Specific Conductance	μ mhos/cm	190-2765 850	180-885 418	115-240 162	75-590 160	145-1210 364
Fecal Coliform	no./100 mL	< 1-56,500 112	< 1-9700 40	0-360 1	< 1-4300 61	< 1-8300 146
Color (True)	units	< 5-45 13	< 5-60 14	< 5-40 9	< 5-70 26	< 5-70 26
Turbidity	NTU	1-56 18	2-40 15	1-14 4	< 1-55 14	6-80 30
Alkalinity, Total	mg/L	3-30 10	0-32 12	3-26 10	0-38 10	6-59 27
Total Suspended Solids	mg/L	< 3-43 14	< 3-27 8	< 3-17 3	< 3-32 5	4-94 33
Volatile Suspended Solids	mg/L	< 3-21 3	< 3-9 3	< 3-3 3	< 3-8 3	< 3-13 6
Total Dissolved Solids	mg/l	136-1478 545	68-555 277	55-156 110	53-329 125	121-702 234
Chloride	mg/L	39-855 262	16-276 110	17-47 30	2-49 13	13-300 75
Sulfate	mg/L	2-17 7	< 1-78 8	9-25 14	< 2-170 36	11-59 24
Total Organic Carbon	mg/L	< 3-13 4	< 3-20 4	< 3-11 4	< 3-15 6	< 3-14 8
Chlorophyll a	mg/L	< 0.001-0.010 0.003	< 0.001-0.012 0.003	< 0.001-0.016 0.007	< 0.001-0.012 0.002	< 0.001-0.048 0.020
Pheophytin a	mg/L	< 0.001-0.003 0.001	< 0.001-0.003 0.001	< 0.001-0.003 0.001	< 0.001-0.001 0.001	< 0.001-0.012 0.004
Ortho Phosphorus	mg/L	< 0.01-0.07 0.01	< 0.01-0.08 0.01	< 0.01-0.06 0.01	< 0.01-0.06 0.02	< 0.01-0.11 0.03
Total Phosphorus	mg/L	0.02-0.16 0.06	< 0.02-0.13 0.05	< 0.01-0.14 0.03	0.01-0.28 0.07	0.05-0.26 0.13
Ammonia Nitrogen	mg/L	0.01-0.29 0.12	< 0.01-0.28 0.05	< 0.01-0.12 0.02	< 0.01-0.96 0.06	< 0.01-0.39 0.09
Nitrate Nitrogen	mg/L	< 0.10-0.52 0.23	< 0.10-0.32 0.10	< 0.10-0.43 0.10	< 0.10-0.43 0.10	< 0.10-0.71 0.26
Selenium	mg/L	< 0.02-< 0.02 0.02	< 0.02-< 0.02 0.02	< 0.02-< 0.02 0.02	< 0.02-< 0.02 0.02	< 0.02-< 0.02 0.02

[a] extremes.

[b] arithmetic means except for fecal coliform, where the log mean average is presented.

Source: SRA, 1981.

mixed spoil; (2) topsoil replacement over mixed spoil; (3) combined topsoil and oxidized spoil over unoxidized spoil; and (4) topsoil over oxidized spoil over unoxidized spoil. The four alternatives would result in various degrees of impacts on runoff characteristics and water quality, primarily reflecting the postmining surface soil medium. This section includes discussions of the potential surface water impacts from the various alternative overburden handling techniques.

6.4.3.1 Peak Flows and Runoff Volumes. Excavation and grading activities associated with construction of overland flow diversion facilities, sedimentation ponds and other surface water and erosion control measures to be implemented prior to mining, in accordance with the surface mining regulations, would alter existing drainage patterns, thereby affecting local runoff volumes and peak runoff rates. Development of the mine would require activities such as timber and brush clearing; pipeline and transmission line relocation; road relocation and construction (e.g., FM 782); construction of one stream diversion and overland flow diversions; site preparation; and construction of haul roads, pit ramps and related facilities. These activities would be expected to increase local peak runoff discharges and volumes on a short-term basis, primarily due to the removal of vegetative cover and the channelization of overland flows in construction areas. However, these impacts should essentially cease upon the completion of the facilities and revegetation of the affected areas (within about two years). Construction of the railroad spur and transmission line from the mine to the MLSES would have a short-term, adverse impact on streams crossed by these facilities (Prospect, Wright, Wasson and Lewis branches and Panther Creek), primarily due to increased runoff and erosion in the construction areas before revegetation is completed. The railroad spur crossings of streams would be sized adequately to prevent constrictions of the stream channels.

Runoff volumes from the site and adjacent areas would be temporarily increased as the land was prepared for lignite removal. However, contributions to peak discharges downstream of these areas would actually be decreased as a result of impoundment in sedimentation ponds, which would be designed and constructed to control the runoff resulting from a 10-year, 24-hour storm, in accordance with RRC regulations. Premining land preparation activities would be performed on relatively small parcels of land in advance of each pit in order to minimize the disturbed area. Comparisons of adverse impacts caused by alternative overburden handling procedures have been made in Sec. 6.2.3.

During active mining, all runoff from disturbed areas would be routed through sedimentation ponds, thereby reducing flood peaks and prolonging downstream discharges. The collection and pumpage of precipitation falling on the active pit would also tend to reduce flood peaks and prolong post-storm streamflow downstream of the mining area. In general, the attenuation of flood peaks and maintenance of sustained flows over an extended period following a storm are regarded as beneficial impacts to the hydrologic regime of the watershed due to reduced flood damages and extended water availability for downstream uses (see Sec. 6.5.3 for impacts to wetlands and flood plains). A portion of Dry Creek, a tributary of Mill Creek, would be temporarily diverted into a parallel channel during mining operations to facilitate the recovery of lignite. Upon completion of mining in the immediate area, Dry Creek would be restored to its approximate original channel location. With the exception of short-term (six months or less) construction-related impacts (e.g., increased erosion), the Dry Creek diversion would not result in adverse surface water impacts. The removal of sedimentation ponds following reclamation would also result in some short-term impacts in the form of increased erosion potential, due to temporary land disturbance by filling and/or regrading. Mitigative measures such as straw dikes or vegetative filters would be employed as necessary to minimize erosion and to prevent adverse effects on surface water.

To determine quantitative impacts from mining in the Martin Lake "D" Area on the peak flows and runoff volumes of area streams, a comprehensive rainfall-runoff model of the watersheds in the immediate project area was developed (Appendix H). The watersheds modeled included the entire Mill Creek watershed above the downstream USGS streamflow gage site (No. 0820980), which encompasses the major portion of the proposed mine area, various tributaries of Tiawichi Creek, which drain northwestward from the proposed mine area, and various tributaries in the Martin Creek watershed, which drain eastward from the proposed mine area. The SCS's TR-20 computer model for project formulation (SCS, 1965) was selected for the rainfall-runoff analyses because of the model's applicability to small watersheds, its conduciveness to reflecting changes in the hydrologic response of a watershed due to mining and its widespread usage for studies of this nature. The watersheds in the Martin Lake "D" Area were modeled for premining (baseline), operational and postmining conditions for a number of storm frequencies and durations, and the results were compared to provide a quantitative assessment of the probable effects of mining and reclamation on the hydrologic responses of the watersheds.

Determination of the exact physical nature of the surface soils which would result from the four alternative overburden handling procedures is not possible. Table 6-2 (Sec. 6.2.3.3) presents calculated ranges of physical properties for postmined soils that could be expected under the various overburden handling techniques. As discussed in Sec. 6.2.3.3, the physical characteristics of the resulting soils would vary depending upon the handling technique used and the soil type being mined. The resulting surface textures could range from loamy sand to sandy clay and would include sandy loam, sandy clay loam and clay loam. Either topsoiling alternative (2 and 4) could result in a more clayey surface with Cuthbert and Kirvin soils. The surface area resulting from mining would be a mosaic of different textural types. No given point would necessarily be the same texture as presently exists. Runoff potential would also vary in a mosaic pattern and all four hydrologic groups would be represented. Since the exact pattern and amounts of surface area having any given runoff potential could not be determined and since a wide range of surface textures would be represented, it was concluded (for modeling purposes) that the premining pattern would most fairly represent overall postmining conditions regardless of the overburden handling technique used. Since postmining topography would approximate premining conditions, slope factors were not varied for purposes of the modeling. Postmining ground cover conditions were based upon information from TUGCO concerning reclamation procedures (see Sec. 5.2.3).

For postmining runoff modeling purposes, it was estimated that five percent of the reclaimed area would be comprised of water surfaces of permanent impoundments, and the remaining 95 percent of the reclaimed area would consist of 90 percent improved pasture and 10 percent forest. The year 1994 was selected, after a review of the mine plan, as a representative year for modeling the hydrologic response of the watersheds under operational conditions. The 1994 operational scenario includes three active mining pits and various areas of reclaimed land and unmined land throughout the project site. The operational condition modeling accounted for the sedimentation ponds which would be in place in 1994 to control runoff from disturbed areas. Postmining conditions were modeled based on the total areas planned for mining and reclamation in the various watersheds.

As the larger watersheds were sub-divided into a number of smaller sub-basins in the model, corresponding to tributary watersheds and intervening areas between tributaries, it was possible to make comparative assessments of runoff peaks and volumes for the storms analyzed at a number of locations throughout the proposed mine area. Documentation of the rainfall-runoff modeling for the Martin Lake "D" Area is contained in a technical memorandum (Appendix H) which includes a description of the model, the formulation of input data and summary tables of the results.

Table 6-14 presents representative results of the hydrologic runoff modeling for premining, operational and postmining conditions at several locations in the project area regardless of the overburden handling technique used. The stream locations for which data are tabulated include both mainstem and tributary locations. In general, operational effects on peak runoff rates are shown to be most significant in individual tributaries which would be substantially affected by prior mining and reclamation (e.g., the Dry Creek watershed). In such instances, peak discharges would be reduced to a large degree because of flood retention in upstream sedimentation ponds. However, total runoff volumes at downstream locations would be affected only slightly, as the impounded floodwaters will eventually be released after the effluents are of sufficient quality to meet the performance standards for total suspended solids, pH, iron and manganese. Therefore, during active mining in the smaller tributary watersheds, peak discharges would be reduced due to the impoundment of floodwaters in sedimentation ponds while the overall effect on the total volume of runoff would be minor. The overall effects of mining and reclamation on peak runoff rates and runoff volumes, expressed as a percentage increase or decrease from premining conditions, are generally more prevalent for storms of smaller magnitude than for larger storms (e.g., the percentage changes attributable to mining are generally greater for a 2-year, 24-hour storm than for a 10-year, 24-hour storm). This situation is a result of the greater peak runoff rates and runoff volumes associated with the larger storms in comparison with the changes in runoff peaks and volumes caused by mining.

The results of the modeling for postmining conditions indicate only minor changes in runoff response as compared to premining conditions. The postmining modeling results show a slight increase in peak runoff rates and volumes in most of the watersheds, due primarily to the decreased percentage of wooded areas under the projected postmining land use. However, the projected changes are minor and, as in the case of operational conditions, the percentage changes decrease with increasing magnitude of the storm analyzed. For instance, Mill Creek at the USGS streamflow gage site downstream of the project boundary is predicted to experience a 5.8 percent increase in peak runoff rate during the occurrence of a 2-year, 24-hour flood and only a 1.1 percent increase in peak runoff rate during a 100-year, 24-hour flood. The minor projected increases in runoff under postmining conditions would not result in adverse impacts on the hydrologic

TABLE 6-14
REPRESENTATIVE RESULTS OF RUNOFF MODELING
MARTIN LAKE "D" AREA

Stream Location	Storm Frequency and Duration	Premining		Operational (1994)[a, b]		Postmining[a]	
		Peak Runoff (cfs)	Total Volume (acre-feet)	Peak Runoff (cfs)	Total Volume (acre-feet)	Peak Runoff (cfs)	Total Volume (acre-feet)
Mill Creek Watershed:							
Mill Creek at Upstream USGS Streamflow Gage Site	2-yr, 24-hr	2,966	1,701	2,711 (-8.6%)	1,625 (-4.5%)	2,970 (+0.1%)	1,710 (+0.5%)
	10-yr, 24-hr	6,993	3,888	6,601 (-5.6%)	3,774 (-2.9%)	6,998 (+0.1%)	3,900 (+0.3%)
	100-yr, 24-hr	12,725	7,048	12,321 (-3.2%)	6,900 (-2.1%)	12,731 (0.0%)	7,063 (+0.3%)
Dogwood Creek at Mouth	2-yr, 24-hr	1,281	280	1,281 (0.0%)	280 (0.0%)	1,275 (-0.5%)	279 (-0.4%)
	10-yr, 24-hr	2,859	605	2,859 (0.0%)	605 (0.0%)	2,851 (-0.3%)	604 (-0.2%)
	100-yr, 24-hr	5,027	1,061	5,027 (0.0%)	1,061 (0.0%)	5,018 (-0.2%)	1,059 (-0.2%)
Dry Creek at Mouth	2-yr, 24-hr	1,720	535	73 (-95.7%)	524 (-2.1%)	1,945 (+13.1%)	596 (+11.4%)
	10-yr, 24-hr	3,731	1,124	150 (-96.0%)	1,110 (-1.2%)	4,021 (+7.8%)	1,208 (+7.5%)
	100-year, 24-hr	6,458	1,942	250 (-96.1%)	1,926 (-0.8%)	6,778 (+5.0%)	2,043 (+5.2%)
Boggy Creek at Mouth	2-yr, 24-hr	1,008	196	1,008 (0.0%)	196 (0.0%)	1,017 (+0.9%)	197 (+0.5%)
	10-yr, 24-hr	2,121	405	2,121 (0.0%)	405 (0.0%)	2,132 (+0.5%)	407 (+0.5%)
	100-yr, 24-hr	3,610	692	3,610 (0.0%)	693 (0.0%)	3,622 (+0.3%)	695 (+0.4%)

TABLE 6-14(Concluded)

Stream Location	Storm Frequency and Duration	Premining		Operational (1994)[a, b]		Postmining[a]	
		Peak Runoff (cfs)	Total Volume (acre-feet)	Peak Runoff (cfs)	Total Volume (acre-feet)	Peak Runoff (cfs)	Total Volume (acre-feet)
Mill Creek at Downstream USGS Streamflow Gage Site	2-yr, 24-hr	3,620	4,374	2,724 (-24.8%)	4,282 (-2.1%)	3,831 (+5.8%)	4,585 (+4.8%)
	10-yr, 24-hr	7,995	9,702	6,351 (-20.6%)	9,552 (-1.6%)	8,201 (+2.6%)	10,001 (+3.1%)
	100-yr, 24-hr	14,259	17,295	13,256 (-7.0%)	17,078 (-1.3%)	14,419 (+1.1%)	17,664 (+2.1%)
Tiawichi Creek Watershed:							
Cass Branch at Mouth	2-yr, 24-hr	1,008	172	1,008 (0.0%)	172 (0.0%)	1,023 (+1.5%)	174 (+1.2%)
	10-yr, 24-hr	2,325	381	2,325 (0.0%)	381 (0.0%)	2,346 (+0.9%)	385 (+1.0%)
	100-yr, 24-hr	4,154	678	4,154 (0.0%)	678 (0.0%)	4,178 (+0.6%)	682 (+0.6%)
Martin Creek Watershed:							
Wright Branch at Project Boundary (county road)	2-yr, 24-hr	1,287	274	1,287 (0.0%)	274 (0.0%)	1,398 (+8.6%)	294 (+7.3%)
	10-yr, 24-hr	2,899	594	2,899 (0.0%)	594 (0.0%)	3,048 (+5.1%)	623 (+4.9%)
	100-yr, 24-hr	5,120	1,045	5,120 (0.0%)	1,045 (0.0%)	5,290 (+3.3%)	1,081 (+3.4%)
Prospect Branch at Project Boundary (SH 43)	2-yr, 24-hr	1,746	315	1,746 (0.0%)	315 (0.0%)	1,790 (+2.5%)	322 (+2.2%)
	10-yr, 24-hr	3,657	650	3,657 (0.0%)	650 (0.0%)	3,711 (+1.5%)	659 (+1.4%)
	100-yr, 24-hr	6,208	1,110	6,208 (0.0%)	1,110 (0.0%)	6,267 (+1.0%)	1,121 (+1.0%)

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[a] Numbers in parentheses denote percentage changes from premining conditions.

[b] Data for some stream locations under operational conditions are unchanged from premining conditions, as mining is not planned within these watersheds prior to 1994.

balance. On the contrary, slight increases in runoff volume may be beneficial in terms of downstream water availability.

6.4.3.2 Normal Flows. Based on the flow-duration and low flow data for area streams presented in Sec. 6.4.1.2 and surface water monitoring programs conducted by the USGS, SWRI and SRA, major streams in the project area, including Mill Creek and Tiawichi Creek, generally experience a baseflow in addition to periodic storm runoff. The probable source of the baseflow component is shallow ground water contribution in the form of seeps and springs. As noted in Sec. 6.3.1.1, the shallow interconnected ground-water system in the project area is comprised of permeable soils and sands of the Carrizo Formation and the shallow sands of the Wilcox Group.

Surface mining activities would unavoidably disrupt the shallow aquifer, and consequently diminish or possibly eliminate ground water-induced baseflow of streams in localized mining areas. As discussed in Sec. 6.3.3, dewatering of the Carrizo and Wilcox would create the potential for diminishing the normal flow of streams traversing the mine area. An analysis of the dewatering impacts on streamflow indicated that the normal flows of various tributaries in the mine area might be dried up as a result of the dewatering activities. However, the major streams in the mine area (Mill and Tiawichi creeks) are not expected to be dried up under mean flow conditions. Under projected conditions, with mine pits no closer than 500 feet to Mill Creek, it is estimated that no more than 10 percent of the flow in Mill Creek could be lost to the mine pits. However, as pit seepage would be collected, pumped out and eventually discharged, a portion of this water would ultimately be returned to the stream network. In addition, impacts of dewatering on normal flows would move incrementally with the mining operations, therefore affecting only specific localized areas at any one time.

6.4.3.3 Impacts on Firm Yield of Lake Cherokee. The location of the Martin Lake "D" Area within the watershed of Lake Cherokee requires an evaluation of potential effects of mining and reclamation on the yield of the lake. Reduction of the reservoir yield is not anticipated under operational conditions, as any reductions in actual runoff from the mined and reclaimed areas should be offset by ground-water pumpage and pit pumpage. Additionally, as the sedimentation ponds would be dewatered following the impoundment of floodwaters, evaporation from the ponds should have a very minor adverse impact, if any, on inflows to Lake Cherokee. Water use for dust supression on haul roads under mine operational conditions could range from 100 to 200 acre-feet per year. This water would be obtained primarily from sedimentation ponds which do not contain lignite fines or a ground water supply, if necessary. The maximum estimated water requirement for dust control of 200 acre-feet per year represents approximately one percent of the firm yield of Lake Cherokee. This impact would cease upon the completion of mining.

TUGCO estimates that approximately five percent of the total mined and reclaimed acreage would be comprised of the water surfaces of permanent ponds remaining after mining depending upon the approved postmining land use. As the permanent ponds are expected to be maintained full (e.g., not dewatered after storms, as during mining operations, except to the extent of evaporation drawdown), an analysis was conducted to quantify the impacts of evaporation from the permanent ponds on the yield of Lake Cherokee. A previous yield study of Lake Cherokee under projected year 2030 watershed conditions indicated the firm yield to be approximately 19,500 acre-feet per year, with the critical drought of record occurring in the period 1963-1964 (URS/Forrest and Cotton, 1975). To evaluate the impacts of permanent pond evaporation on the yield of Lake Cherokee, the previous yield study was repeated with hypothetical permanent ponds (having a total surface area of five percent of the total mined and reclaimed area) located in the watershed upstream of Lake Cherokee. The resulting year 2030 firm yield computed for Lake Cherokee under this condition was approximately 19,000 acre-feet per year, or a reduction 2.6 percent from the previously computed firm yield. Documentation of the yield studies for Lake Cherokee is included in the technical memorandum covering the rainfall-runoff modeling discussed in Sec. 6.4.3.1 (EH&A, 1982).

6.4.3.4 Water Quality. According to preliminary mining plans, a maximum of two square miles (less than 1.5 percent of the Lake Cherokee watershed) would be disturbed with excavation or reclamation activities during each of the 30 years of mining. Surface runoff from disturbed areas of the mine, including spoil piles, cleared areas in advance of the mining operation and areas being reclaimed, would be routed to sedimentation ponds. Discharge from the sedimentation ponds would be subject to EPA's NSPS for the coal mining industry (Sec. 5.3, Table 5-3). The effluent limitations and the constituents to be monitored are based upon pH and/or iron concentration of surface runoff from disturbed or reclaimed areas and water collected from the mine pit, prior to any treatment. If the water has a pH of less than 6.0 or a total iron concentration of more than 10 mg/l, the drainage is considered acid or ferruginous (iron) while if the pH is more than 6.0 and the total iron concentration is less than 10 mg/l, the drainage is considered alkaline. Under non-precipitation conditions, the NSPS limitations require control of pH, iron and total suspended solids (TSS) (sediment) for alkaline drainage and those parameters in addition to manganese for acid drainage. Exact effluent limits are given on Table 5-3. Under precipitation conditions of less than the 10-year, 24-hour event, pH and settleable solids (instead of TSS) must be controlled, while for events greater than the 10-year, 24-hour storm, only pH need be controlled. The substitution of settleable solids limits for the TSS limits during precipitation events leads to the release of more suspended solids into streams than the NSPS limits prior to amendment of the standards in 1982. Prediction of the limits which should be enforced can frequently be made (before mining begins) from site specific water quality data. Site specific surface-water and ground-water quality data are presented in Tables 6-4, 6-5, 6-11 and 6-13; the average pH is approximately 7.0 and the iron concentration is less than 10 mg/l. For this project, EPA is proposing an NPDES permit which requires monitoring manganese levels (without effluent limits) in addition to the parameters required for alkaline drainage. Manganese would be monitored to determine if the levels released with discharges are a potential problem. Discharge limits are shown on the preliminary NPDES Permit in Appendix C.

Expected sediment pond performance was extrapolated from an extensive set of discharge water quality data collected over several years at three existing TUGCO mine sites. Although numerous discharges had TSS concentrations greater than the normal (dry weather) standard of 70 mg/l, TUGCO proposes that all of these occurred as a result of precipitation events, and none occurred during dry weather conditions. Similar compliance with normal dry weather standards is expected for the proposed discharges. Based on the performance data obtained at the existing Martin Lake, Monticello and Big Brown facilities, similar compliance with the EPA alternate wet weather limitations on settleable matter is expected. Maximum observed concentrations were at or below the 0.5 ml/l standard during the three months of sampling at the Martin Lake facility, for all but two of the 26 months of data collection at the Monticello facilities, and for all but one of the 33 months of sampling at the Big Brown site (Appendix I). The TSS and settleable solids contained in the discharges from the sediment ponds are not expected to have a significant effect on area streams. Suspended solids from mining areas consist primarily of soils suspended in runoff water. There are no stream standards in Texas established for TSS because of the large natural variations of TSS levels. Levels are high when streams are muddy after rainstorms and low during periods of low flow. The mining area sediment ponds are expected to prevent excessive sediments from entering area streams and should not significantly alter the natural sediment loadings.

Heavy metals analyses on sediment pond discharges at the existing Martin Lake site have been performed by the RRC since 1978. A summary of these data is presented in Table 6-15 and indicates that toxic levels (toxic to plants) of heavy metals have never been observed. The constituent concentrations have also been below the TDWR maximum allowable concentrations of hazardous metals (TDWR, 1982). Similar concentrations of heavy metals are expected in the proposed sediment ponds discharge, and consequently, problems of runoff toxic to plants or aquatic organisms associated with metals are not expected. As a result of utilizing sediment ponds for the control of lignite fines, as discussed in Sec. 5.2, any impacts to surface water from lignite fines should be insignificant. Surface runoff from reclaimed areas would be subject to effluent limitations until the land was released from bond. If, at some later date, water quality monitoring indicated that adverse impacts to the aquatic ecosystem might occur as a result of the release of heavy metals or other constituents (Sec. 6.2.3.5), more detailed programs could be instituted. An example is the site specific approach using bioassays which is discussed in "Proposed Approach for Control of Toxic Industrial/Wastewater Discharge" (EPA, proposed guidelines).

Initial temporary impacts to water quality downstream of the project area would be restricted to construction activities related to installation of surface water control facilities. Vegetation stripping and earthmoving activities would result in increased erosion potential of the affected areas, so that higher than normal sediment yields may be delivered to area streams if precipitation occurs before completion of the facilities. The Dry Creek diversion channel would contribute to increased sediment loadings downstream until protective vegetation is thoroughly established. Fertilization to aid in the reestablishment of vegetation during the reclamation phase would temporarily increase nutrient levels of surface runoff to area streams. Impacts to wetland and flood plain vegetation are addressed in Sec. 6.5.3.1. As discussed in Sec. 6.10.3.1, the potential for a secondary long-term, insignificant adverse impact from acid deposition exists. If, from whatever source, acid deposition increased, it could cause decreased pH (increased acidity) in the surface waters. No impacts to surface waters would result from ground-water discharge since ground-water quality should not be affected (Sec. 6.3.3).

Quantification of water quality impacts on the Lake Cherokee watershed was accomplished for two operational scenarios. Long-term average annual mass loadings from the mine site and the entire Lake Cherokee watershed were calculated for major constituents. Mining sequence information such as annual magnitudes of disturbed areas were incorpo-

TABLE 6-15

SUMMARY OF HEAVY METAL ANALYSIS ON SEDIMENTATION DISCHARGES[1]

Metal	Period Sampled	No. of Samples	Range (ppm)[2]	Average (ppm)[2]	Levels Toxic to Plants/Animals (ppm)[2, 3]	TDWR Allowable Concentrations (ppm)[2, 3]
Manganese	1978-1982	123	<0.01-2.8	0.21	1.0 to 5.0	1.0
Selenium	1978-1982	67	-	<0.01[5]	2.0	0.05
Arsenic	1978-1982	18	<0.01-0.04	0.01	0.5 to 10.0	0.1
Cadmium	1979-1981	19	-	<0.01[5]	0.005 to 0.010	0.05
Chromium	1979 & 1981	3	<0.02-<0.05	-	0.5 to 50.0	0.5
Lead	1979 & 1981	8	-	<0.01[5]	0.1 to 240	0.5
Mercury	1979 & 1981	10	<0.0001-0.0004	0.0002	0.001 to 0.050	0.005
Zinc	1979	6	<0.01-0.02	0.016	0.1 to 1.0	1.0

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[1] Data from RRC sampling program at Martin Lake "A," "B" and "C" Areas.

[2] ppm - parts per million.

[3] Source: U. S. EPA. Quality Criteria for Water. Office of Water and Hazardous Materials. July, 1976.

[4] Source: Texas Dept. of Water Resources, 1979. Permanent Rules, as amended. Section 156.19.15.002. Austin, Texas.

[5] All samples were less than 0.01 ppm.

rated in this analysis. A worst-case analysis projected the effects of a 10-year 24-hour storm event at the disturbed areas in conjunction with median flow conditions in the remaining watershed. Deviation from baseline water quality conditions in Lake Cherokee was estimated in response to both scenarios.

Long-term Analysis. A computer simulation of 40 years (1980-2019) of watershed hydrology and water quality was conducted to characterize the long-term mining impacts. A combination of conservative (total dissolved solids, dissolved sulfate and dissolved chloride) and nonconservative (total suspended solids and total iron) constituents were analyzed. A description of the computer model development and implementation is provided in a technical memorandum (Appendix H).

Several records of hydrologic and water quality data were incorporated, including the USGS and SRA efforts mentioned previously as well as a hydrologic investigation by URS/Forrest and Cotton, Inc. (1975). Long-term average annual watershed yield, reservoir content, net evaporation and diversion rates, constituent loadings and water quality conditions in Lake Cherokee were calculated and used as a basis for comparing mining impacts. The results of the simulations are presented in the technical memorandum.

The estimates of mining loads on Lake Cherokee indicate that water quality impacts would be minor and temporary. Individual constituent concentrations deviated less than six percent from long-term average conditions. Water quality standards were not violated for any parameter. The minor impacts are attributed to the relatively small percentage of areal disturbance, coupled with the compliance with sediment pond effluent water quality regulations. For all constituents, concentrations would return to average levels very shortly after mining ceased. This is attributed to the rapid flushing rate of Lake Cherokee. No detrimental effects to existing uses of Lake Cherokee would occur.

Storm Event Analysis. A similar simulation was conducted to characterize a short-term, high-load scenario of stormwater discharges from disturbed areas on median flows in the remaining watershed. To assess the impact of storm loads from the disturbed area, the concentrations are compared to the baseline median flow conditions for the entire watershed. The results are presented in the technical memorandum. As with the long-term simulation, the impacts of loads from the disturbed area would be relatively minor.

As mentioned earlier, the lower portion of the watershed between the two Mill Creek stations contributes a significantly smaller load of chloride than the upstream watershed, resulting in a reduced concentration at the downstream station. The net reduction in dissolved chloride concentrations is more apparent during high flow conditions in this contributing watershed (e.g., the 10-year, 24-hour storm scenario) yielding lower chloride concentrations in the lake.

6.5 WETLANDS AND FLOOD PLAINS

6.5.1 Existing Environment

6.5.1.1 Wetland Communities. Specific responsibilities for protection of wetlands is contained within the Clean Water Act. The stated objective of the Act is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Section 404 of the Act requires the issuance of a permit by the U. S. Army Corps of Engineers (COE) for the release of dredged or fill material into "Waters of the United States." Included as part of "Waters of the United States" are wetlands, which are defined in 33 CFR 323.2(c) as:

> . . . those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

A field investigation of the project site was conducted by the COE. A determination was submitted to EPA on April 16, 1982 (Appendix J). A total of 1,359 acres of wetlands within the area of jurisdiction under Section 404 of the Act was determined to exist inside the project boundary. Subsequently, TUGCO revised the project boundary thereby reducing the acreage of wetlands inside the boundary. Thus, a total of 850 acres of wetlands within the area of jurisdiction exist within the project boundary. Approximately 84 acres (9.4 percent) of wetlands occur in areas to be mined, reclaimed and/or traversed by roads, pipelines, transmission lines, diversions, etc. (see Sec. 6.5.3.2). Some bottomland forests are wetlands but are described with flood plain communities.

Swamps. The predominant type of swamp in the study area is seasonally inundated and occurs mainly along the flood plains of Mill, Tiawichi and Dogwood creeks. Observable waterlines are often present on the trunks of trees, and scattered wet depressions occur over the nearly flat terrain. Common overstory species include black tupelo, American hornbeam, waterelm, overcup oak, sweetgum, slippery elm and southern red oak. Bald cypress frequently occurs in the scattered depressions. The understory stratum is typically poorly developed with scattered overstory saplings and other shrub species such as Virginia sweetspire. Vines, such as Japanese honeysuckle, greenbriar, Alabama supplejack, and American buckwheatvine may also be present. Common components of the herbaceous layer include common lizardtail, smallspike falsenettle, Virginia arrowarum, and various sedges and grasses. Numerous mosses may also occur on tree trunks at or near the water mark.

Marshes. Marshes occur primarily along the peripheries of ponds and streams. The largest concentrations of marsh habitat occur along Tiawichi Creek, Mill Creek and Dogwood Creek. Most marshes within the study area would be classified as "broad-leaved deciduous, scrub-shrub wetland" according to Cowardin et al. (1979). Dominant species include saplings of red maple, sweetgum and black tupelo in the scattered or peripheral overstory; and Virginia sweetspire, hazel alder common buttonbush, southern waxmyrtle and blueberries in the usually dense shrub stratum. Various sedges and Virginia arrowarum may form an almost solid ground cover.

Bogs. Bogs are typically located in seepage areas at the bases of upland slopes, where permanent seeps and springs maintain saturated soil conditions. Dominant species in the scattered overstory include sweetbay and black tupelo. In the shrub stratum, Texas azalea, Virginia sweetspire and shiny viburnum are common. The herbaceous stratum is dominated by such ferns as chainfern, sensitivefern and southern ladyfern, with common lizardtail, Hypericum walteri, and Virginia arrowarum also common. Species of sphagnum moss that also occur in seepage bogs on the site include Sphagnum cuspidaum, S. lescurii, S. palustre, and S. perichaetiale (a species previously known only from Hardin and Tyler counties). In addition, such uncommon species as Trillium texanum and whorled isotria (Isotria verticillata) occur immediately upslope from boggy habitats in the study area.

Other Aquatic Habitats. Approximately 210 acres (0.8 percent) of the study area are composed of aquatic habitats (e.g., ponds and streams). Typical species along the water's edge of these habitats include black willow, common buttonbush, cattail, smartweed, seedbox, arrowhead, common rush and sedges. Spatterdock cowlily often covers portions of the water's surface.

6.5.1.2 Flood Plain Communities. Flood plain communities in the project area include bottomland hardwood forests and pastures that may be seasonally inundated. Bottomland hardwood forests occur upon flood plains associated with permanent and intermittent bayous and streams. Important overstory species in the bottomlands include sweetgum, river birch, red maple, Florida maple, black tupelo and American hornbeam. Water oak, willow oak and loblolly pine occur less commonly. Common buttonbush is a common understory species, while seedlings of various overstory species in association with various sedges and other herbs comprise a usually sparse ground cover.

Pasturelands which occur in flood plains of the project area are generally dominated by sedges (*Cyperus* spp. and *Carex* spp.), common rush (*Juncus effusus* var. *solutus*), lovegrass (*Eragrostis* sp.), smartweed (*Persicana* sp.), panic grasses (*Panicum* spp.), and saplings of red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), water oak (*Quercus nigra*), and common buttonbush (*Cephalanthus occidentalis*). This type of community also occurs in wet depressions throughout the project area.

6.5.2 Impacts of No Action Alternative

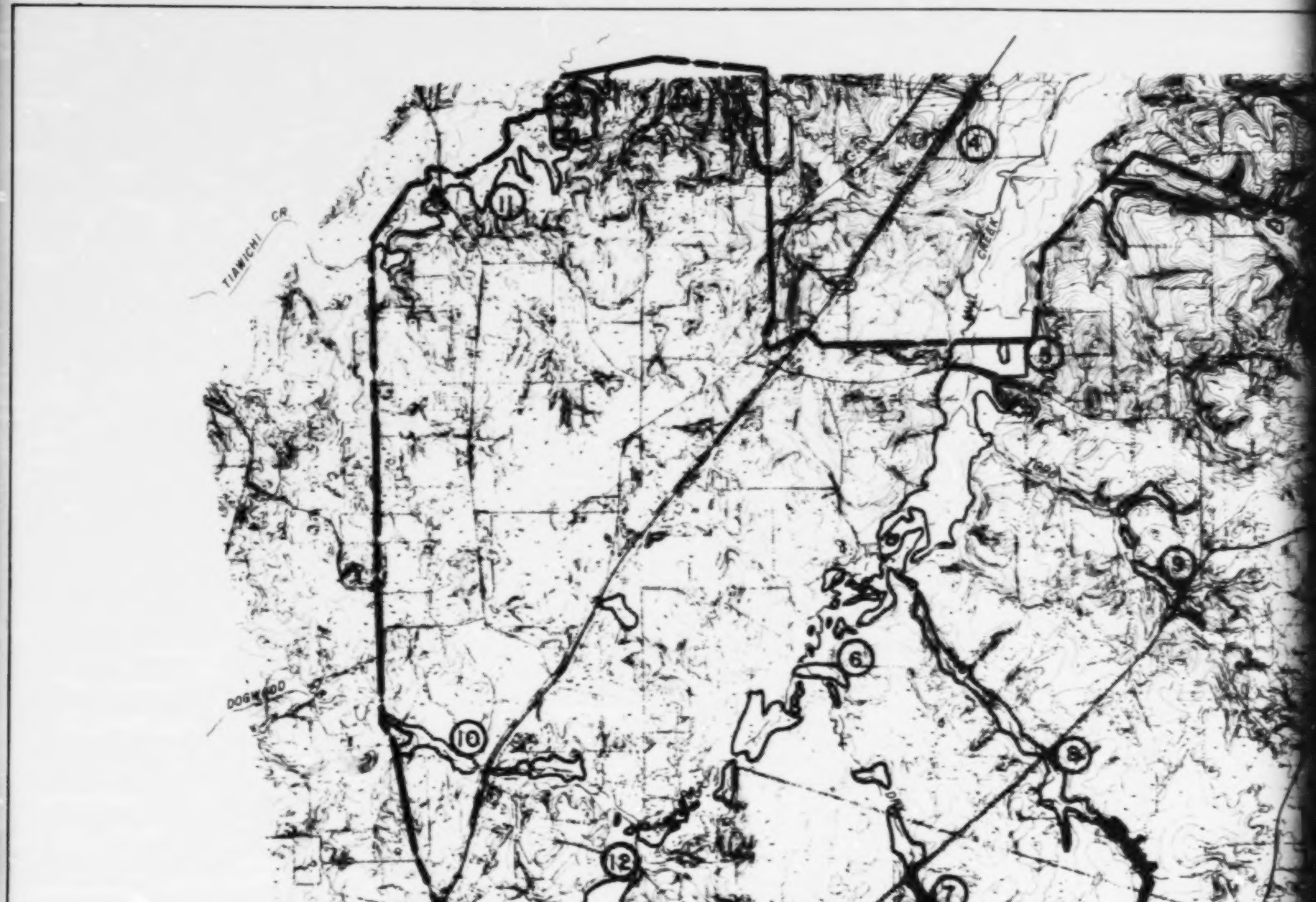
The no action alternative would have no adverse impacts on wetlands and flood plains or on the associated bottomland forests. Available data indicate that bottomland forest acreage is increasing in Rusk County and nearby areas (Cruickshank, 1938; USDA, Forest Service, 1956; Earles, 1976). The natural reforestation of bottomlands previously cleared for agricultural purposes is the apparent reason for this increase. This conclusion is supported by a significant decline in acreage occupied by farms (ETCOG, 1977).

6.5.3 Impacts of Project Alternatives

6.5.3.1 Construction Impacts. Flood plain and wetland plant communities would be removed by the construction of the railroad spur, the transmission line, various ROW relocations, haul roads, the temporary diversion of a 2,000-ft portion of Dry Creek and other mine site facilities such as the loading station, erection pad, sewage treatment plant, and offices. A total of about 40 acres of wetlands determined to be within the area of jurisdiction under Section 404 (COE letter, April 16, 1982) within the proposed project area would be affected by the various ancillary facilities listed above (TUSI, 1981). This is less than six percent of the total wetlands under COE jurisdiction within the revised project area (Sec. 6.5.1.1). Approximately two acres would be impacted by a haul road near site 1 (Fig. 6-14). Another 21 acres of wetlands would be mined and reclaimed after the temporary diversion of part of Dry Creek at site 7 (Fig. 6-14). Most of this wetland acreage at site 7 is currently cleared and being used as pasture. The diversion would have to be approved by the RRC and meet requirements to ensure maintenance of hydrologic regime and to provide erosion control. The relocation of FM 782, a haul road and possibly a pipeline relocation are proposed to cross the reclaimed area. The construction of haul roads and relocations of pipelines and transmission lines would be planned to minimize impacts to wetlands. This is accomplished primarily by selecting routes that avoid these wetlands. Other than the roads and pipelines described above, it is expected that about 17 acres of wetlands would be affected by crossings in the project area. A haul road crossing of Mill Creek would be required in about 15 years and a Section 404 permit if necessary, would be applied for at that time (TUSI, 1982).

Flood plain plant communities which could be affected by the ancillary facilities, other than wetlands, include bottomland hardwood forest and hydric communities. The railroad and transmission line would preempt 11.0 and 9.4 acres, respectively, of bottomland hardwood forest. In addition, the transmission line would preempt 3.6 acres hydric habitats (swamps and marshes). Within the project area, the transmission line relocation and the temporary diversion of part of Dry Creek would preempt 8.4 and 0.2 acres, respectively, of bottomland hardwood forest. The preliminary nature of the haul road lay out does not allow for the determination of vegetation types or acreages which could be affected.

The adverse impacts to wetlands from construction activities are considered to be long term, since they would preempt flood plain and wetland vegetation for the life of the mine (about 30 years) or longer before the facilities were removed and the acreage reclaimed. The only exception is the short-term (two years) but significant, adverse impact of temporarily diverting a 2,000-ft portion of Dry Creek. The time required for revegetated areas to reach maturity and stability would be longer. Adverse impacts on flood plain and wetland plant communities caused by soil erosion and increased stream sediment loads could be minimized by establishing a vegetative cover as soon as feasible on areas disturbed by construction. Sedimentation is proposed to be controlled by sedimentation ponds, hay-bale barriers, catchment basins, and overland flow-interceptor channels. The construction of sedimentation ponds would cause short-term, adverse impacts to wetlands and flood plains located downstream by increasing sediment loads. The adverse construction impacts to wetlands and other flood plain vegetation communi-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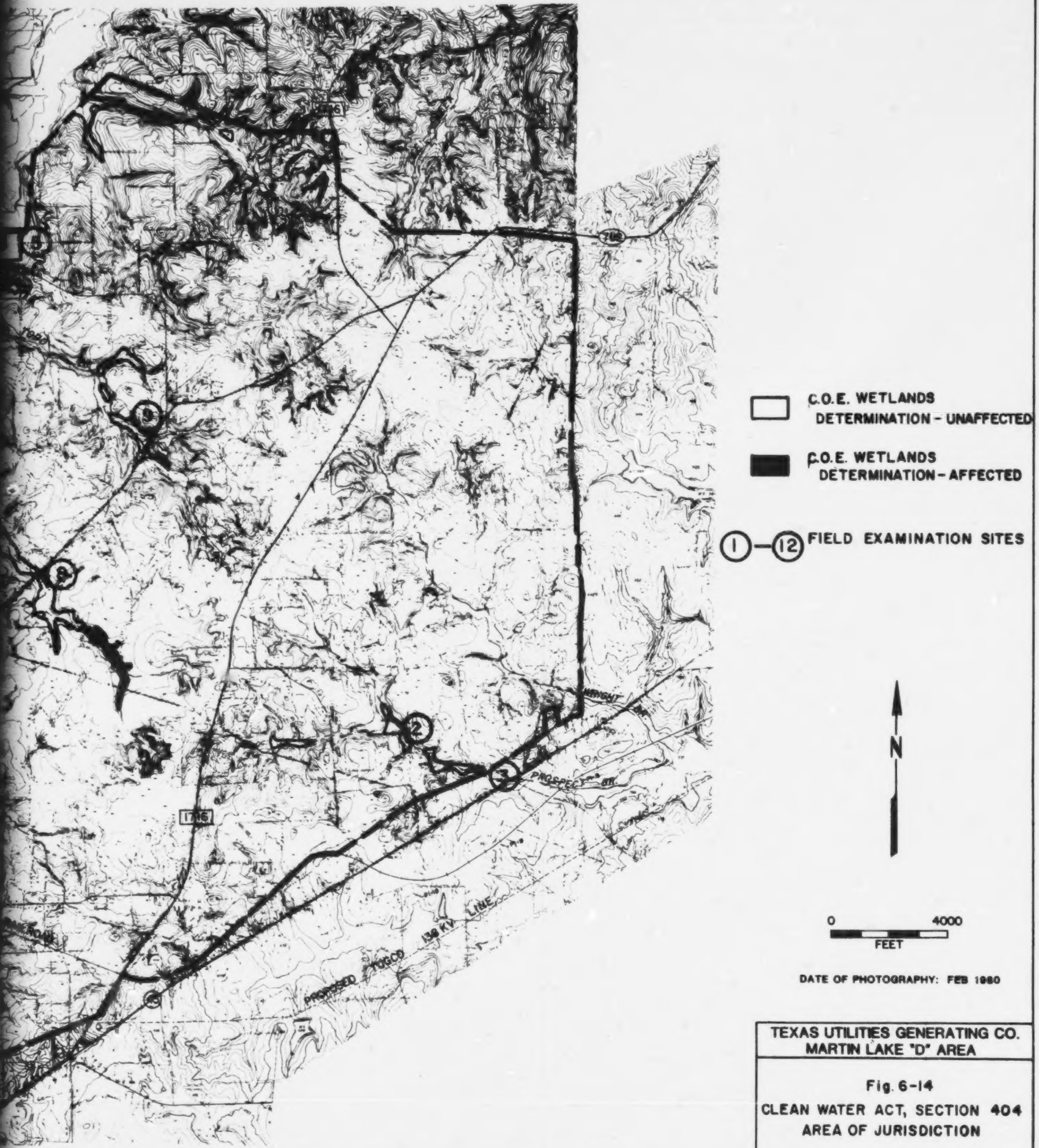
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DATE OF PHOTOGRAPHY: FEB 1980

TEXAS UTILITIES GENERATING CO.
MARTIN LAKE "D" AREA

Fig. 6-14
CLEAN WATER ACT, SECTION 404
AREA OF JURISDICTION

ties would be mitigated to some degree by the creation of some small new ponds and adjacent wet areas during reclamation. Adverse impacts to sensitive flood plain and wetland vegetation could also be mitigated by careful avoidance during the actual location and routing of the ancillary facilities.

6.5.3.2 Operational Impacts. The wetland acreage (850 acres) occurs primarily in level areas in the flood plains of the project area streams. Surface mineable lignite seams have been naturally eroded during geologic history under most of the streams and wetlands. This natural geologic condition plus the RRC requirement for 100-foot mining buffer zones near streams (except where authorized stream diversions are allowed) would result in the avoidance of the great majority of the wetlands within the proposed project boundary. A total of approximately 44 acres of wetlands within the proposed project area would be mined and reclaimed (TUSI, 1982), which is approximately 5.2 percent of the total wetland acreage. Wetlands within mining blocks exist as small, widely separated areas. Specific wetlands proposed to be mined and reclaimed consist of the following (see Fig. 6-14):

Site 1 Approximately nine acres of forested wetlands at the north end of Site 1 are planned to be mined and planted during the first five-year period. It would take about 10 years for trees to begin producing seeds and as much as 30 years before an essentially closed canopy was achieved. An additional two acres would be affected by a haul road to be placed adjacent to the mined area.

Site 2 Less than nine acres of forested wetlands at the west end of Site 2 are planned to be mined and reclaimed.

Site 8 During the first five years of mining less than five acres at the southern tip of Site 8 would be mined and reclaimed. After 1998, approximately 20 additional acres of forested wetlands would be mined and reclaimed.

Other flood plain communities occurring within the mining blocks include bottomland hardwood forest and hydric plant communities. Bottomland hardwood forest within the proposed mining blocks occupies 1,039 acres (Sec. 6-6, Table 6-16), which represents approximately 2.4 percent of the 43,400 acres of bottomland hardwood forest in Rusk County in 1975 (Earles, 1976). In addition, 53 acres of hydric plant communities (swamps and marshes) exist within the mining blocks. These communities would be largely avoided

TABLE 6-16

VEGETATION COMMUNITIES

MARTIN LAKE "D" AREA PROJECT SITE

Category[1]	Total Project Site		Within Mine Blocks[2]	
	Acres	Percent	Acres	Percent
Pine Plantations/Managed Pine Forests	1,218	4.9	665	3.7
Regeneration/Cutover Areas	3,795	15.2	2,822	15.8
Upland Pine/Hardwood Forests	3,290	13.2	2,079	11.6
Bottomland Hardwood Forest Communities	1,924	7.7	1,039	5.8
Pasturelands (Improved, Native, Hayfields, Oldfields)	13,135	53.6	10,259	57.3
Croplands	1,229	4.9	865	4.8
Hydric Communities	162	0.6	53	0.3
Other Aquatic Habitats	210	0.8	134	0.7
Total	24,963		17,916	

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[1] The categories listed here are based upon different criteria than land use categories (Table 6-23). Thus, acreages for categories with similar names are not the same in both tables.

[2] See Fig. 1-2 for location of generalized mine blocks.

during mining since lignite generally does not occur beneath the streams of this area and the RRC regulations require a 100-ft buffer zone between mining activities and streams unless a closer distance is specifically approved.

The introduction of monoculture vegetation on the disaggregated postmining surface material requires intense management and is not an ideal environment for the reestablishment of a stable diverse, complex plant communities. In natural communities, species diversity is directly correlated with habitat variability. For example, variability of and discontinuity in topography and subsurface features are necessary to allow development of diverse communities (such as bogs, and their unique flora, adjacent to seepages). As a result of general reconstruction of the surface contours, along with the natural influences of wind and water erosion, some habitat diversity would become established after several years. Micro-communities such as bogs and mesic cove forests would have a low probability of becoming re-established. However, other suitable plant communities (e.g., mixed upland hardwood forest) would be established. Also, surface water may be retained along diversion ditches and within local depressions. Such localized areas of surface-water retention would be a beneficial impact, since additional hydric habitat would be created.

An adverse ground-water impact unique to the operational phase would be the lowering of the ground-water head during dewatering. As discussed in Sec. 6.3.3.2, dewatering would cause a significant, adverse impact to localized areas along the upper portions of tributary creeks in the project area. During approximately 10 to 23 years required for recharge of ground-water, the upper portions of tributaries would experience desiccation. Even minor changes to the water input could have adverse consequences for wetlands and flood plain plant communities dependent upon seeps and springs along these tributaries. After recharge, wetlands and other hydric communities may be created at different locations and, thus, compensate for the long-term adverse impact upon wetlands and flood plains not re-established by the ground-water recharge. No ground-water impacts, however, are expected to larger flood plains (Sec. 6.3.3.2).

Adverse impacts caused by the deposition of spoil would be more enduring than those associated with dewatering. The disturbed geologic materials may retard the up-gradient recharge of springs and seeps. The ground-water flow to streams in the vicinity of the mine area could be further reduced by being diverted around reclaimed areas and away from traditional discharge points. The alteration of recharge zones in both alluvial and shallow sand formations, in addition to the aforementioned ground-water impacts, could reduce the long-term baseflow to springs and streams within the Martin Lake "D" Area. The potential reduction or elimination of the artesian discharge could be expected to eliminate or alter any wetland communities that are dependent on that discharge. The primary adverse impact would be long-term desiccation, which would be significant in the upper reaches of tributary streams in the project area.

Adverse effects upon water quality downstream of the project area for the most part would be restricted to construction activities related to installation of surface water control facilities. Vegetation stripping and earthmoving activities would result in increased erosion potential, so that higher than normal sediment yields may be delivered to area streams if precipitation occurs before completion of the facilities. Susceptibility to erosion would be minimized by clearing only the land immediately ahead of the overburden removal process and by initiating vegetation establishment measures as soon as possible following soil reconstruction. At most, about 500 acres of land would be exposed to potential erosion at any given time. The short-term adverse impacts on downstream water quality and the dependent wetlands should be minimized since all discharges must comply with State Water Quality Standards for segment 0505 of the Sabine River and EPA's NSPS for coal mine discharges. The effects of those impacts which would occur are discussed below and in Sec. 6.7.3. Compliance with the regulations for establishing a well-designed surface water control system would ensure that impacts to water quality downstream from the mine are temporary and minor during actual mining; however, no such assurance could be made for the long-term as much is dependent on stable, diverse ecosystem development.

As discussed in Sec. 6.4.3.1, local peak runoff discharges and volumes would temporarily increase during pre-mining construction and land clearing activities, then decrease during active mining as all runoff is routed through sedimentation ponds, and finally return to near normal as revegetation is completed. A more long-term impact to surface water quantity supplied to downstream wetlands would be the disruption of shallow aquifers in mined areas which may diminish ground water-induced baseflow. Possible dewatering would have a similar impact, but would be more short-term. Since mining operations would avoid the major streams in the area, including Mill Creek and Tiawichi Creek, the baseflows of these streams should not be significantly affected and the quantity of streamflow to downstream ecosystems should not be adversely impacted over the long-term.

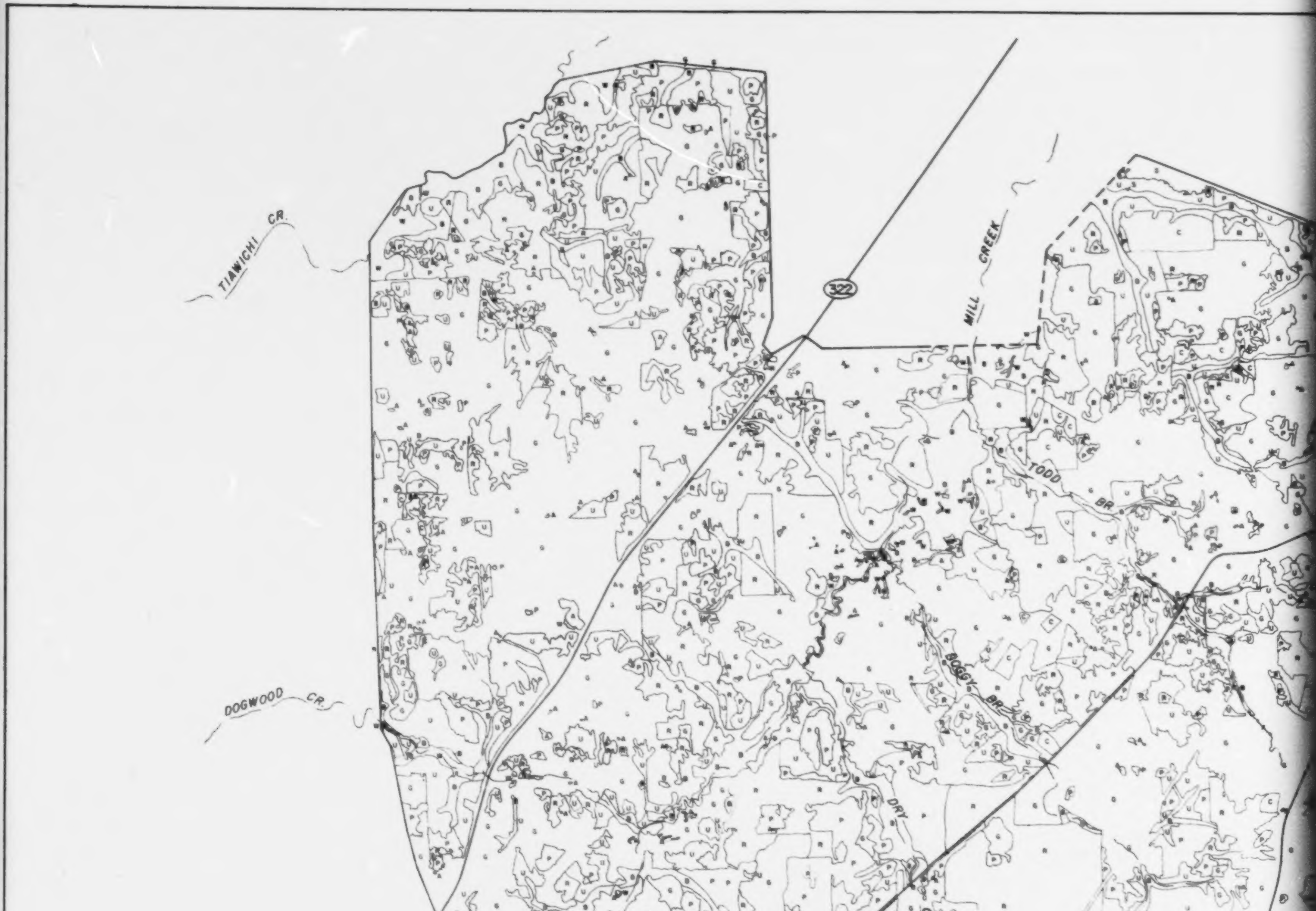
Impacts to the variety of functions served by wetlands could result from all of the activities discussed above, i.e., construction of facilities, mining lignite beneath a wetland, dewatering, alteration of ground water discharge and changes in peak runoff discharges and volumes. Impacts could result from factors such as: destruction of wetland vegetation, increased sediment loading from erosion and desiccation caused by alterations in ground water or surface-water regimes. Direct destruction of wetlands would have the most severe impact by totally removing that acreage of functioning wetland. Impacts from the other factors would tend to reduce the capacity of wetlands to function as effectively as filtration mechanisms to ensure downstream water quality and would lessen the high quality habitat provided by the wetlands. This is particularly true for desiccation. For this project, less than 10 percent of the wetlands within the project boundary would be totally removed. Those wetlands proposed to be removed are primarily along the upper reaches of the smaller tributaries and the main acreages of wetlands within the project boundary along Mill and Tiawichi creeks would not be affected. In addition, at least an equal acreage of wetlands exist along Mill and Tiawichi creeks outside the project boundary and these would be completely unaffected. Impacts from increased sediment loads would be controlled and minimized by the sedimentation ponds required by RRC regulations. Impacts from changes in the ground- and surface water regimes could affect wetland functions but, again, the primary effects would occur in wetlands along the upper parts of tributaries, not to the main acreage of wetlands along Mill and Tiawichi creeks or to those wetlands outside the project boundary. More information about impacts to the quality of habitat is provided in Secs. 6.6.3.1 and 6.6.3.2.

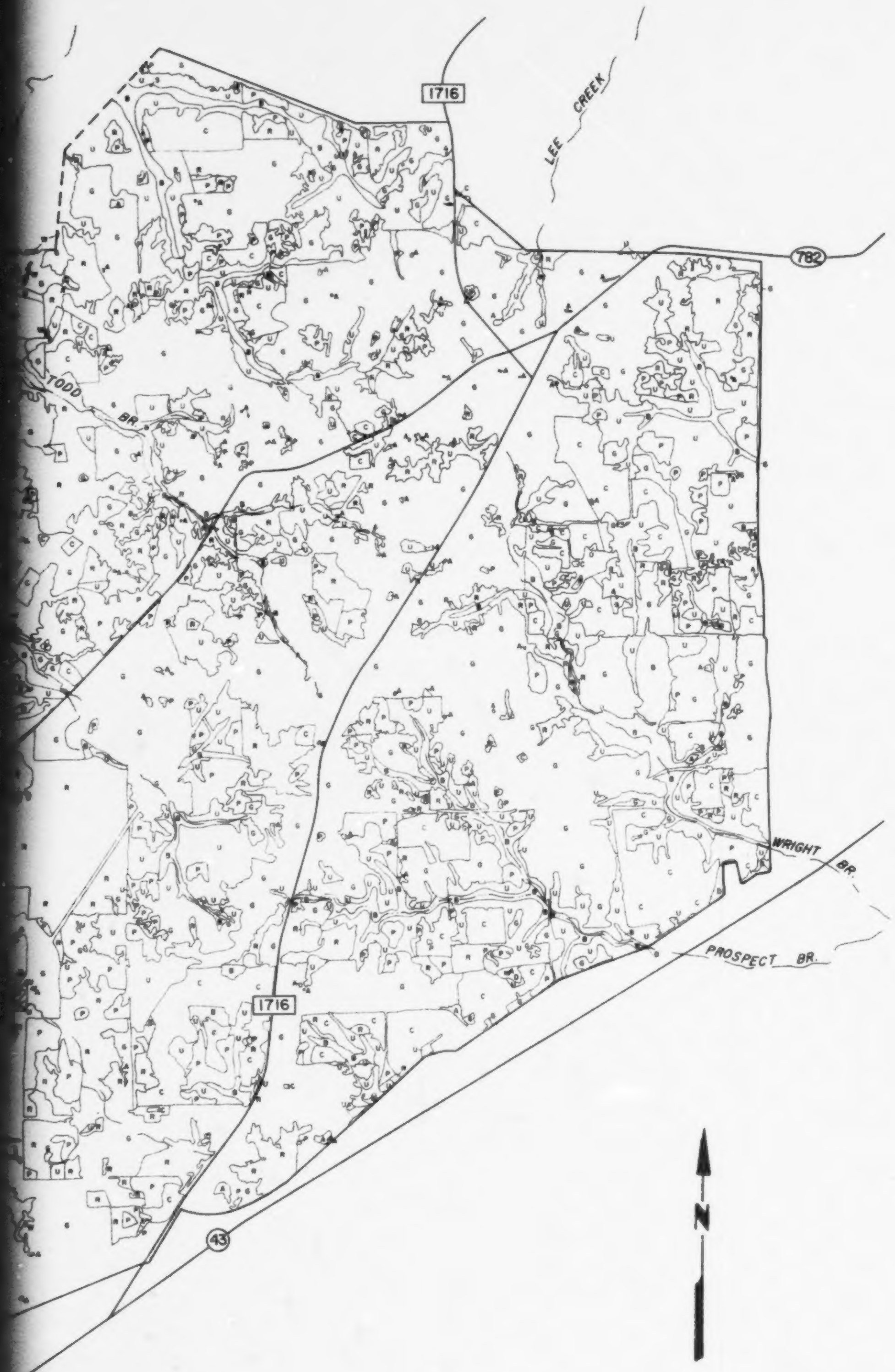
6.6 TERRESTRIAL BIOLOGY

6.6.1 Existing Environment

6.6.1.1 Vegetation. Ten major plant communities occur within the project area (Fig. 6-15). These communities include managed pine plantations/forests, regeneration/cutover areas, upland pine/hardwood forests, bottomland hardwood forests, pasturelands, croplands, swamps, marshes, seepage bogs and aquatic habitats (e.g., ponds) (Table 6-16). This section discusses the biotic communities of upland areas within the Martin Lake "D" Area. The biotic communities of wetlands and flood plains are discussed in Sec. 6.5.

Pine Plantations/Managed Pine Forests. Managed pine plantations (planted) and forests include occasional pine plantations/forests in well-drained bottomlands, as well as the


TIAWICHI CR.
322
MILL CREEK
TODD BR.
DOGWOOD CR.
BOGGY BR.
DRY
CREEK
322
1716
43
MILL CREEK
782



LEGEND

MAP UNIT	MAP UNIT NAME
U	Upland Pine / hardwood forest
P	Pine plantation / managed pine forest
R	Regeneration / cutover area
B	Bottomland hardwood forest
W	Hydric communities
S	Seepage bog
A	Other aquatic habitat (i.e. pond,stream)
G	Grassland (pasture, hayfield, right-of-way, etc.)
C	Cropland (row crop)
D	Disturbed area

0 4000
FEET

DATE OF PHOTOGRAPHY : FEB 1980

TEXAS UTILITIES GENERATING CO.
MARTIN LAKE "D" AREA

Fig. 6-15

VEGETATION COMMUNITIES

typical upland occurrences discussed below. Pine plantations are generally composed of even-aged shortleaf pine or loblolly pine. In managed pine forests, hardwood species are selectively cut for timber improvement.

In addition to shortleaf or loblolly pines as overstory dominants, other species are occasionally or frequently interspersed through the canopy. Sweetgum is a common subdominant, while white oak, southern red oak and others also occur. When present, the understory and shrub layers are typically composed of flowering dogwood, hawthorne, southern red oak, eastern redcedar, sweetgum, southern waxmyrtle, red maple and others. Vines such as greenbriar, muscadine grape, Virginia creeper and poison ivy are usually frequent. Pine litter commonly covers the forest floor (except following controlled burns), and as a result, the herb layer is usually sparse.

Regeneration/Cutover Areas. The majority of this vegetation type is a result of lumbering in upland pine forests and consists of uneven-aged pine saplings. Areas of regeneration also occur in areas which were formerly bottomlands where lumbering has occurred. Natural regeneration of abandoned croplands and pasturelands is also included in this category. Species composition of regeneration/cutover areas varies depending on soil and topographic factors, as well as the composition of surrounding vegetation. Species typical of regeneration/cutover areas in the project areas include loblolly pine, sweetgum, eastern redcedar, common sassafras, broomsedge and western ragweed.

Upland Pine/Hardwood Forests. The structure of the upland pine/hardwood forests found within the project boundary is variable, depending upon successional status, present disturbances, and historical factors. Many so-called native stands have been subjected to selective cutting for timber improvement. In some stands, most of the hardwoods have been eliminated. Mesic upland forests on the project site, also included in the upland pine/hardwood mapping category, are relatively small areas within steep-sided stream valleys, where protection from direct insolation and particular soil conditions provide favorable conditions for the development of mesic forest stands.

Dominant overstory species include loblolly pine, shortleaf pine, southern red oak, post oak, black hickory, sweetgum, and eastern hophornbeam. The more mesic stands have an overstory dominated by black tupelo, sweetgum, white oak, eastern hophornbeam, and red mulberry. The understory and shrub layers of upland stands are usually quite dense, providing approximately 20 to 75 percent canopy cover. Dominant species in the understory include winged elm, eastern redcedar, flowering dogwood, sweetgum, Carolina buckthorn, red maple, American holly, black tupelo, eastern redbud, eastern hophornbeam, and American hornbeam. Common shrubs include saplings of eastern redcedar, flowering dogwood, black tupelo, American holly, sweetgum, and various oaks, along with American beautyberry, farkleberry, southern waxmyrtle, and common sassafras. The herbaceous stratum is dense and composed of various seedlings, grasses and other herbs.

Pasturelands. Upland pasturelands, comprising 13,135 acres (53.6 percent), are predominantly hayfields and improved pastures planted in coastal and common bermudagrass, bahiagrass or dallisgrass. Oldfields (abandoned cropland) and native pastures were also included as part of this plant community. Such grasses as Paspalum spp., Panicum spp., bermudagrass, bluestem, winter bentgrass, and little bluestem, occur. Weedy species include heartwing sorrel, yankeeweed, bitterweed, soft goldaster, Rudbeckia hirta, western ragweed, asters, partridge pea, and woolly croton.

Croplands. Watermelons are the predominant crop in the area, with some small fields of corn, sorghum, or other agricultural crops also occurring.

6.6.1.2 Wildlife. The proposed project lies within the western portion of the Austroriparian Biotic Province as described and delineated by Dice (1943) and Blair (1950). As noted by Blair (1950), the Austroriparian of Texas is, with few exceptions, similar in terms of fauna and vegetation to the rest of the province which extends eastward to the Atlantic Coast. Extensive forests of pines and hardwoods, along with scattered swamps, marshes, and other hydric habitats are characteristic of the Austroriparian Province. This also typifies the project area along with a significant proportion of primarily man-made open habitats (e.g., pastureland, hay fields and cropland). Based on site-specific wildlife studies the vertebrate fauna of the project area is also generally typical of that expected in the Austroriparian Biotic Province (EH&A, 1981c).

Wildlife Habitats and Characteristic Fauna. Wildlife habitats of the project area can be placed into recognizable categories which coincide closely with the vegetational communities previously described in Secs. 6.5.1 and 6.6.1.1. These habitat types are: (1) upland forest (including the vegetational communities of pine plantations/managed pine forest, regeneration/cutover areas, and upland pine/hardwood forest); (2) bottomland hardwood forest (flood plain forest); (3) open terrestrial habitats (including pasturelands and croplands); (4) hydric habitat (including swamps and marshes); and (5) aquatic habitats (including lakes, ponds and streams). Because of structural similarities between some habitat (for instance, swamps and bottomlands are both wet wooded habitats), there is some overlap in the wildlife species which may be considered dominant or characteristic of certain habitats. Bottomland forest, hydric habitats and aquatic habitats may be further categorized as being flood plain and wetland habitats.

Terrestrial Habitats. Upland forest represents a significant percentage (33.3 percent) of the project area. Since the major land use in upland forest on the site is logging, the stage of development (from young, recently cleared forest to old mature forest) depends on how recently the area has been logged and on the type of logging that has occurred. Upland forest varies from almost pure pine stands to mixed stands of pines and hardwoods. Recently clear-cut areas represent the earliest developmental (successional) phase of the upland forest in the project area, while steep slopes and other areas that have not been subjected to clearing or intensive logging typically support the most mature stands. The vegetational species present in the upland forest of the project area, the dominance patterns of the species in relation to one another, and the physical structure of the vegetation all are important factors in determining the bird species which are present and the dominance patterns of the species in relation to one another. Because of the variation in upland forest as described above and in Sec. 6.6.1.1, the bird communities as well as many other components of the wild fauna change over time as the development phases of the upland forest change. In young forests of the project area, common wildlife species often include the Yellow-breasted Chat, Prairie Warbler, White-eyed Vireo, Common Yellowthroat, Hispid Cotton Rat, Fulvous Harvest Mouse, and Texas Rat Snake. Clearcut areas with standing snags may also have a fair number of woodpecker species. Mature mixed forest stands are commonly occupied by such species as the Kentucky Warbler, Pine Warbler, Black-and-white Warbler, Tufted Titmouse, Summer Tanager, Cadinal, White-footed Mouse, Eastern Woodrat, Fox Squirrel, Ground Skink and Buttermilk Snake. Pure monoculture pine stands do not support as large a variety of species as do the other upland forest habitats, though some species such as the Pine Warbler and Carolina Chickadee may be common.

Open terrestrial habitats have the largest aerial coverage of any habitat in the project area with pastureland occupying over 57 percent (13,135 acres) with cropland adding nearly 5 percent (1,229 acres). Croplands typically support fewer wildlife species than pasturelands due to the monoculture nature of the vegetation and the regular disturbance of soils and cover. Nonetheless, some species such as the Common Crow, Brown-head

Blackbird, House Mouse, and others may be locally or seasonally common depending on the availability of food and cover. Pasturelands, which are more vegetationally complex, support a larger variety of wildlife species that often includes the American Kestrel, Bobwhite, Common Crow, Eastern Meadowlark, White-throated Sparrow, Field Sparrow, Fulvous Harvest Mouse, Hispid Cotton Rat, Eastern Cottontail, Nine-banded Armadillo, Coyote, Six-lined Racerunner, Texas Rat Snake, Woodhouse's Toad and others.

Wetlands and Flood Plains. Bottomland forest in the project area occupies about 5.8 percent (1,924 acres); however, this habitat type is important due to its high value to a variety of wildlife species. Common wildlife species of bottomland forests in the project area include the Carolina Chickadee, Prothonotary Warbler, Acadian Flycatcher, Red-eyed Vireo, Yellow-billed Cuckoo, Gray Squirrel, White-tailed Deer, Cotton Mouse, Raccoon, Virginia Opposum, Southern Copperhead, Five-lined Skink, Gray Treefrog and Three-toed Box Turtle. Other characteristic but typically less common species include the Pileated Woodpecker, Wood Thrush, Hooded Warbler, Barred Owl, Carolina Wren and others.

The wildlife of wooded hydric habitats (i.e., swamps) are similar in many ways to that occurring in the bottomland. Species such as the Gray Squirrel, Prothonotary Warbler, Raccoon and Gray Treefrog which are common species in the bottomlands are also common swamp fauna. In addition, more typically aquatic species such as the Beaver, Yellow-bellied Water Snake, Bronze Frog, Mississippi Mud Turtle and Western Cottonmouth are common. Unforested hydric communities (i.e., marshes) in the project area also support a large variety of aquatic and wetland species including the above-mentioned species and others such as the Great Blue Heron, Red-winged Blackbird, Muskrat, Southern Leopard Frog, Northern Cricket Frog, Green Treefrog, Broad-banded Watersnake and others.

Aquatic habitats in the project area support a variety of species including many of those mentioned previously as being common in bottomlands and hydric habitats. Amphibians such as the Gray Treefrog and Woodhouse's Toad which may inhabit the forested and/or open terrestrial areas during much of the year must return to water to breed. Many other amphibians are even more closely tied to water because of such factors as their susceptability to desiccation and their required food sources. Many wildlife species use aquatic areas as a source of food as well as fresh water. Common wildlife species of the aquatic habitats in the project area include the Red-eared Slider, Bullfrog, Southern

Leopard Frog, Northern Cricket Frog, Bronze Frog, Yellow-bellied Water Snake, Western Cottonmouth, Beaver, Raccoon and others.

6.6.1.3 Important Species. Important species, as defined or implied in various environmental regulations are those that: (1) are commercially or recreationally valuable; (2) are threatened or endangered; (3) affect the well being of some important species within criteria (1) or (2); or (4) are critical to the structure and function of the ecological system or are biological indicators.

Recreationally or Commercially Important Species. Commercially important plant species in the area primarily include pines (loblolly pine, shortleaf pine) and both forage and row crops. Coastal bermudagrass is most widely used in the area's improved pastures. Though presently under-utilized in the project area, hardwoods such as oaks, hickories and elms are potentially important as commercial species.

The White-tailed Deer is the most important big game mammal in the area. The estimated 1980 deer population for Rusk County was 3,700 deer or 8.2 deer/1000 ac (Texas Parks and Wildlife Department (TPWD), 1981a). It is reasonable to assume that this figure is typical of the project area as well. The highest density recorded in any county in 1980 was 144.9 deer/1000 ac and the lowest was 0.3 deer/1000 ac. Deer signs and a few individual deer were observed during baseline surveys of the project area.

The Bobwhite is an important game bird in Texas (TPWD, 1981a). Bobwhite density estimates for the Pineywoods ecological area (which includes Rusk County) during 1980 showed a mean count of 0.7 quail/20-mile route (standard TPWD route for monitoring quail populations). This is probably typical of the project area as well. The highest estimate for the state in 1980 was 23.8 quail/20-mile route and the lowest 0.6 quail/20-mile route.

Mourning Dove density for the Pineywoods ecological area was 10.9 doves heard/15-mi route during 1980. The high for Texas in 1980 was 32.8/15-mi route and the low was 8.3/15-mi route.

The Fox Squirrel and Gray Squirrel are important small game mammals throughout much of Texas. Squirrel densities in Texas bottomlands during the spring of 1980 census showed that the Pineywoods region had 101 squirrels/100 ac. In the fall of 1980, the bottomlands of the Pineywoods had a high of 316 squirrels/100 ac. The spring 1980 high for any of the Texas ecological regions which were censused by TPWD was 248/100 ac and the low was 92/100 ac.

The Eastern Cottontail and Swamp Rabbit, although not strictly defined as game animals, are hunted throughout their range in Texas. According to TPWD (1981a), the density of cottontails in the Pineywoods was 1.4/20-mile route during 1980 which was the state low, while the high was 4.8/20-mile route. Swamp Rabbits were not observed in the Pineywoods region during the 1980 TPWD census but were observed in appropriate habitat in the project area during field studies; however, no density estimates are available. Schmidley et al. (1979) state that Swamp Rabbits are common in all vegetation regions of east Texas.

Furbearers (e.g., Raccoon, Virginia Opossum, Gray Fox, Striped Skunk, Bobcat and Mink) are of economic and recreational importance in certain parts of Texas. Spain and Frentress (1981) stated that 185,000 furbearers were harvested in the Pineywoods Area in 1979. The most common species harvested were the Raccoon, Virginia Opossum, Striped Skunk, Nutria, Coyote and Gray Fox. The Raccoon, Virginia Opossum and Striped Skunk appeared to be the most common furbearers in the project area. They were most abundant in wooded stands, especially the bottomland forests.

Other Important Species. Dominant species are, by definition, critical to the structure and function of the ecological system and, therefore, qualify as important species under criterion (4). Species identified (EH&A, 1981a) as important browse or forage plants for wildlife in the project area qualify as important species under three different criteria: (1), (3) and (4). Upland pine/mixed hardwood forests are of highest value in terms of wildlife food and habitat structural characteristics. Also of high value as wildlife habitat are bottomland hardwood forests, those forested stands which are disturbed or offer abundant "edge" habitat, oldfields and native pastures. The least valuable wildlife habitats are offered by pine plantations and improved pastures.

6.6.1.4 Ecologically Sensitive Areas. In general, an area may be considered sensitive if: (1) it supports a rare plant or animal community or a rare, endangered or threatened species; (2) it is a highly productive habitat having substantial commercial or recreational value; and/or (3) it supports species considered to be wetland indicators.

The bottomland forest (Sec. 6.5.1.2) and wetland communities (Sec. 6.5.1.1) may be considered sensitive both as wetlands and as highly productive wildlife habitat. In addition, there are streams that, because of underground conditions, have water containing high dissolved salts (relative to the area in general) and a low pH. While these areas are not sensitive, they are unique as naturally acidic systems. The fauna and flora of these streams are poor in diversity and density (EH&A, 1981c).

6.6.2 Impacts of No Action Alternative

6.6.2.1 Vegetation. The no action alternative would prevent adverse impacts associated with the proposed project, but the total acreage of natural upland forest in Rusk County would continue a steady decline primarily through the conversion of forested land to agricultural uses (such as pasture) and the increased urbanization of the cities of Henderson and Kilgore (Murphy, 1976). A related development which would add to the decline is the recent expansion of commercial pine forest (plantations) acreage by planting and seeding of open areas. To meet the future demand for pine timber in east Texas, where recent harvests have equaled or exceeded annual growth (Koehler, 1980), the expansion of pine forest acreage would depend upon the conversion of upland mixed hardwood forest (Murphy, 1976).

Forest is the last developmental stage for terrestrial vegetation in Rusk County (Kuchler, 1964; Braun, 1950). As defined by the U. S. Forest Service, commercial forest land consists of all forest in Northeast Texas except for an insignificant acreage of forest withdrawn from timber utilization (Burtleson, 1982). Therefore, the impacts to natural terrestrial (upland) vegetation in the project area may be predicted based upon historical commercial forest acreage figures published by the U. S. Forest Service for Rusk County in 1917 (Foster, 1917), 1935 (Cruikshank, 1938), 1953-1955 (USDA, Forest Service, 1956), 1965 (Sternitzke, 1967), and 1975 (Earles, 1976; Murphy, 1976). In Rusk County, total commercial forest acreage decreased from 345,000 ac in 1917 to 291,400 ac in 1975. Decline in total forest acreage has been approximately 0.27 percent annually for the 58-year period between 1917 and 1975. In the latest time period (1965-1975) for which figures have been compiled, the total forest acreage in the county has declined at an annual rate of 0.41 percent. Bottomland hardwood forest and wetlands (Turner, et al., 1980) in the proposed project area, comprise 14.9 percent of the total commercial forest acreage in the county for 1975. The steady increase in bottomland hardwood forest discussed previously (Sec. 6.5.2) points to the accelerating rate of decline of natural upland terrestrial vegetation as being even more significant than indicated by the above data.

6.6.2.2 Wildlife. The no action alternative would prevent the adverse impacts of construction and operation of the proposed project. However, as is evident from the land use (Sec. 6.11.2) and vegetation (Sec. 6.6.2.1) discussions of no action, the trend in land use of the project area will likely result in gradual reduction of mature forestland. This will adversely affect forest wildlife species (by removal of their preferred habitat) and benefit grassland species. The net effect of this trend is negative because of the higher wildlife value typically ascribed to forested habitats.

6.6.3 Impacts of Project Alternatives

6.6.3.1 Vegetation. Unavoidable adverse impacts during site preparation and construction activities include destruction of natural vegetation in those areas to be mined and in those portions of the ancillary area where haul roads, a dragline erection pad, surface-water control structures, powerlines, service structures and various right-of-way relocations would be constructed. During the life of the mine, approximately 17,916 acre of primarily forest and pasture vegetation would be removed prior to actual mining activities (Table 6-16). This would be an incremental operation in advance of the overburden removal to minimize the amount of disturbed area as mining progresses. Excluding flood plain and wetland plant communities discussed in Sec. 6.5.3, terrestrial vegetation to be preempted by the transmission line and the railroad spur total 114.3 acres and 262 acres, respectively. The transmission line would preempt predominantly pastureland (71.7 acres), while the railroad spur would preempt 142 acres of pastureland and 120 acres of upland pine/hardwood forest. The transmission line relocation within the project area would preempt an additional 83.2 acres, of which 37.9 acres consist of pastureland and 32.1 acres consists of regeneration/cutover areas and upland pine/hardwood forest (and 13.2 acres of other types). The temporary diversion of Dry Creek would preempt 9.8 acres, of which the predominant type is pastureland (6.1 acres). At this time the acreage preempted by haul roads cannot be determined.

The above adverse impacts on terrestrial vegetation are primarily considered to be long-term and significant, since they would preempt the original vegetation for the life of the mine (30 years) or longer. The exception is the temporary diversion of Dry Creek. The incremental nature of mining and subsequent reclamation, however, would limit the area impacted by mining to an average of 500 ac/yr. This yearly increment of vegetation disturbed by mining would consist, on the average, of approximately 57.3 percent pastureland, 15.8 percent revegetation/cutover areas, and 11.6 percent upland pine/hardwood forest (Table 6-15).

Land clearing, mining operations and traffic would create wind-blown particulates from both soil and lignite, which would accumulate on adjacent vegetation. If sufficient pyritic material is present in the dust and the pH becomes low enough, aluminum, manganese and other trace metals could be made available for uptake by plants, causing minor phytotoxicity (toxicity to plants) (Hons et al., 1978; Bryson, 1973). These adverse impacts should be localized because the total amount of area affected at any time would be relatively small. Mitigation would be water spraying of roads to reduce dust.

Although agricultural systems such as pine plantations, pasturelands and croplands contain ecologically complex communities of soil microorganisms and intricate chemical balances that influence productivity, they are relatively simple with regard to both floral and faunal diversity when compared with undisturbed natural ecosystems such as forests, wetlands or prairies. For example, pasture lands and croplands can be restored in only two to three years and pine plantations may be harvested for pulp within 15 to 16 years (Skove, 1982). Restoration of existing natural plant communities, predominantly upland pine/hardwood forest, in the mined area would be more difficult and would require a longer period of time than for pine plantations, pastures and croplands. Therefore, the alteration of the natural habitats would have a more long-term adverse impact. Upland pine/hardwood forest would be reclaimed to 10 to 50 percent of the total acreage mined. This means that even if all 2,079 acres within the mine blocks were cut down (see Table 6-16), the acreage reclaimed to forest would be between 1,792 and 8,958 acres (based upon 17,916 acres in the mining blocks). Development of natural species diversity and relatively complex community structure characteristic of natural forest ecosystems would depend to a large extent on the process of natural succession. This process would be accelerated, at least with respect to common species, by the planting of woody species. During the early stages of succession after reclamation, common, easily dispersed plant species would invade the area, resulting in high net community productivity and low species diversity. The later successional stages would exhibit relatively low net productivity and high species diversity.

The reclamation plans provide for re-establishing the approximate original contours, soil preparation, establishment of vigorous ground cover, and proper management of vegetation following establishment. Reclamation would establish a combination of pasture and woodland. Erosion control prior to the establishment of a permanent vegetative cover would include temporary cover crops, temporary contour terraces and mulching. The oxidation of the pyritic material generally found in association with lignite can result in more acid soil conditions (Hons et al., 1978) and potentially allow the release of phytotoxic concentrations of metals resulting in stunted or dead vegetation; TUGCO's mining procedures include provisions to minimize impacts to wildlife and reestablish wildlife habitat on some reclaimed areas. Disturbances ahead of mining would be minimized. The clearing of vegetation would be limited to a narrow strip (200 feet wide) adjacent to the active mine pit. Trees and wooded areas would be avoided where removal is not required to accomplish mining activities. Vegetation is reestablished promptly on reclaimed areas which would limit unvegetated areas to approximately 500 acres at any one time. Area streams are not planned to be mined (except for a short section of Dry Creek). These streams and the 100-foot buffer zones on each side required by the RRC would remain undisturbed, allowing existing vegetation to retain its beneficial habitat qualities. Large grassland areas on reclaimed land would be broken up by establishment of strategically placed shrub and wooded areas. These areas would be established where approved by RRC, primarily in drainage areas and around permanent ponds created in reclamation areas to provide cover and travel corridors for wildlife. These ponds and surrounding riparian (adjacent to or living on the bank of a river, lake or pond) vegetation would provide areas for use by wildlife including migrating birds and provide cover for small mammals. The permanent ponds would be stocked according to pond depth, size and location, with various species including channel catfish, largemouth bass and sunfish. Selective ponds would also be stocked with crawfish and amphibious species such as frogs. Hunting would not be allowed on Company controlled land in the mining area. TUGCO would have to receive approval from the RCC for Fish and Wildlife Plans for each five-year area. Wildlife and habitat development procedures would also be discussed with appropriate agencies such as TPWD and the Rusk County Soil and Water Conservation District.

Table 6-17 lists those tree and shrub species to be used as revegetation species for wildlife habitat. Of these, the primary species to be utilized for replacement of riparian habitat would include ash, birch, baldcypress, eastern cottonwood, oak, sycamore and black willow. Other approved species would be used in smaller quantities on riparian areas.

TABLE 6-17

TREES AND SHRUBS TO BE USED AS REVEGETATION SPECIES FOR WILDLIFE HABITAT

ash
beautyberry, American
birch
baldcypress
bittersweet, American
catalpa, southern
cypress, Arizona
cherry
coffeetree, Kentucky
cottonwood, eastern
elm
hackberry
hawthorn
hickory
holly
honeylocust
honeysuckle
lespedera, shrub
locust, black
maple
mulberry, red
oak
olive, autumn
olive, Russian
osage-orange
persimmon
pine
plum, wild
redbud, eastern
redcedar, eastern
sassafras
sumac
sweetgum
sycamore
tallow-tree, Chinese
walnut, black
waxmyrtle
willow, black

6.6.3.2 Wildlife. Construction and operation activities associated with the proposed project would result in increased noise, dust and human activity in the project area. Noise resulting from the project (Sec. 6.10.3.2) is not anticipated to have significant adverse impacts. This conclusion is supported by studies concerning airport noise, repelling ducks from airports, sonic booms, and other noise related factors (Busnel, 1978; Thiessen et al., 1957; Lynch and Speake, 1978; Janssen, 1978; Shaw, 1978). Dust in the project area could result in some short-term impacts to vegetation (see Sec. 6.6.3.1); however, this impact is expected to have only a relatively minor short-term, adverse effect on wildlife species. Increased human activities in the area could result in disturbance to some species; however, avoidance of high activity areas by sensitive wildlife should prevent any significant impacts. Noise, dust and human activity effects would be localized, thereby further reducing the significance of these factors.

The previously discussed vegetation clearing and associated habitat disturbances (see Sec. 6.6.3.1) would result in significant adverse impacts on the wildlife resources of the project area. Initial construction clearing activities would result in the death of many forms of wildlife, such as small amphibians, reptiles, mammals and lower age classes of birds, which cannot avoid construction activities. Wildlife species capable of avoiding direct physical harm would be forced into adjacent habitats where competition for food, cover, nesting sites and other potentially limiting life requisites occur. It is assumed that this competition would result in increased mortality, decreased reproductive success, or other population stresses that would eventually reduce the population to its former levels. Clearing activities are considered a long-term adverse impact because of the resulting elimination or reduction of the wildlife productivity of those areas. The clearing of 140 acres for construction of the ancillary mine facilities (such as the crusher, train loading station, etc.) constitutes a long-term, significant, reversible impact by the loss of about 35 acres of upland pine/hardwood forest, 35 acres of regenerating upland forest and 70 acres of pasturelands, all of which are considered to be moderate to good quality wildlife habitat. Adverse effects on wildlife species which inhabit bottomland forest would be minimal since most such areas would not be mined. Clearing of the mining blocks would occur throughout the 30-year life of the mine and would take place a few hundred feet in advance of the operating draglines. Thus, even though the mining blocks encompass 17,916 acres, the actual area in which clearing is ongoing would be much smaller. Wildlife species that would be adversely affected by this clearing include those species previously discussed in Sec. 6.1.2.1 as being typical of the habitats to be cleared (primarily pasturelands, upland pine/hardwood forest and regeneration/cutover areas).

Operation of the draglines would result in the removal, mixing and eventual replacement of the overburden materials. This activity would eliminate the structural variety of ground and below-ground micro habitats and would result in an area devoid of logs, small limbs, leaves and other organic debris that might otherwise provide cover for the remaining wildlife left after the vegetation clearing. All den sites, nest sites, cover, and other important habitat components would be eliminated.

The type of wildlife species which would inhabit the post-mining areas and the nature of the wildlife communities would depend to a major extent on the practical application of the reclamation plan (including fish and wildlife habitat enhancement measures) and on postmining land use. Based on the reclamation plans, the postmining fauna of the mined area would differ greatly from the existing wildlife communities. Numerous studies have documented similar adverse impacts on strip mined areas (e.g., Cantle, 1978; Brewer, 1958; Kirr, 1969; Allaire, 1979; Wray et al., 1982).

Reclamation of the mine blocks would begin within one year after the replacement of the spoil. Reclaimed pastureland would be established primarily with coastal bermudagrass. This habitat would be of limited value to wildlife, although a few species may occur there in good numbers (e.g., Brown-headed Cowbirds, Killdeer and Eastern Meadowlarks). From 50 to 90 percent of the mined area would be reclaimed as improved pasture. The establishment of strategically placed shrub and wooded areas within the large pastureland areas would provide some diversity in habitat as suggested by Dickson and Vance (1981) and Spain and Frentress (1981). These wildlife areas would be located primarily in drainage areas and around permanent ponds created in reclamation areas and would provide cover and travel corridors for wildlife.

From 10 to 50 percent of the postmining land use of the mined area would be managed and unmanaged upland forest. Thus, following soil stabilization in such areas, pine trees (primarily) would be planted and a long-term succession would begin toward the development of mature forests. However, because of the lack of habitat diversity in these forests, their wildlife value initially would be rather limited. Species which might utilize these areas would change over the 15 to 30 years before timber harvesting could occur again. Intermediate stages, before the growing pines shade out and eliminate the ground layer herbaceous species, would likely attract the greatest number of wildlife species, though with less diversity than a "natural" regeneration forest. During these intermediate stages this habitat would offer the greatest variety of vegetational resources. Subsequent cuttings (perhaps 50 to 80 years after reclamation of the forest) should be followed by more vegetationally diverse intermediate stages which would be of greater value than the initial reclamation plantings. The initial loss of diversity followed by a long period before diversity increases to near the level before mining constitutes a long-term, significant, adverse impact to wildlife habitat in this area.

Once the pine canopy dominates the habitat, the wildlife value of the reclaimed pine forest would fall significantly. This habitat would be characterized by little ground cover, except pine needles, and a monoculture overstory which would provide neither diversity nor good quantity of wildlife foods or cover. Some species such as the Pine Warbler, Yellow-rumped Warbler, Ruby-crowned Kinglet, Carolina Chickadee and others might be fairly common; however, most woodland species require greater habitat variety. Many woodland species that currently inhabit portions of the mine blocks (e.g., Prothonotary Warbler, Gray Squirrel, Pileated Woodpecker, Great-crested Flycatcher, Wood Thrush and others) would be either totally excluded or greatly limited in such areas. Population studies such as those by Dickson and Segelguist (1979), Dickson et al. (1980), Dickson (1978), and Meyers and Johnson (1978) support this conclusion. In the case of strip-mining, the differences between the reclaimed forest and "natural" forest would be even greater due to the removal of seeds and roots which increase the diversity of plants in early and late developmental stages. Bottomland and swamp habitats which were mined would be even more difficult to re-establish; however, as noted earlier, these habitats would be avoided to a large extent.

A number of procedures would be implemented to develop and enhance the value of the reclaimed land for wildlife. Initial disturbance of mining would be minimized by limiting clearing of mine blocks to a narrow strip adjacent to the mine pit. Trees and wooded areas would be avoided where possible. Timely revegetation efforts would limit unvegetated areas to about 500 acres at any given time. With one exception (a short section of Dry Creek), project area streams and a 100-foot buffer zone on each side would remain undisturbed allowing existing vegetation to retain its beneficial habitat qualities. This would also act as a source of seeds which, through natural dispersion, would aid in reestablishing a diversity of floral species, and is a recommended method of reducing wildlife impacts from mining (Spain and Frentress, 1981). Permanent ponds with riparian vegetation would be established and stocked with various gamefish as well as aquatic organisms such as frogs and crayfish. Other wildlife habitat would be established (as noted previously) along small drainages in the mine blocks. These areas would be planted with riparian tree and shrub species that have value as wildlife food and cover. Upland wildlife habitat would also be established, where appropriate, along fence rows, pipeline corridors, transmission line corridors, roads or other suitable areas. See Sec. 6.6.3.1 and Table 6-17 for species to be planted in both upland and riparian areas.

6.7 AQUATIC BIOLOGY

6.7.1 Existing Environment

6.7.1.1 Aquatic Habitats. The aquatic environment of the Martin Lake "D" Area consists of a drainage network of permanent and intermittent streams ultimately draining into the Sabine River, swamp and marsh areas associated with those streams, and man-made stock ponds. Mill Creek and its tributaries drain about 66 percent of the site. Prospect Branch and Wright Branch drain about 25 percent of the site, and Tiawichi Creek, which forms the northwestern boundary, drains the remaining 9 percent. The main streams, and many of the larger tributaries, are perennial by USGS standards, but zero flow conditions, with water present in isolated pools, is a common late summer and fall condition. Extensive swamp and marsh areas are located in the flood plains along the lower reaches of Mill and Tiawichi creeks. Small wetland areas, including hillside seeps and bogs, are scattered throughout the project site. These habitats and their vegetation are discussed in Sec. 6.5.1.1.

Stream substrates in the Martin Lake "D" Area consist of silts, sands and gravels, with the smaller particle sizes (sands and silts) predominating. Occasional occurrences of concrete road and bridge rubble approximate cobble-boulder-slab riffle habitat. Channel morphology exhibits a pool-riffle pattern in most of the area streams, with the dominant habitat type being silt-bottomed pools. Some streams (e.g., Tiawichi Creek, Todd Branch) with predominantly sand substrates have a shifting channel-bar morphology with few large pools or riffles.

As a result of the prevalence of dense, riparian cover along the area streams, accumulations of woody debris and leaf pack provide a substantial portion of the invertebrate food base and cover in many channel reaches. This organic matter input also results in the wide spread occurrence of organically loaded, and often anaerobic, sediments. Those areas having sand substates (Tiawichi Creek, Todd Branch) generally contain smaller amounts of organic detritus. Substantial stands of aquatic macrophytes are restricted, because of shading by riparian vegetation, to cleared areas, such as road crossings pastures, and reaches with broad, level channel beds.

Stream waters in the project area ranged from slightly to strongly acid (6.1-3.8) at the time of the survey, and conductivities were generally moderate. Measured oxygen concentrations were all below saturation, presumably because of extensive shading and occurrence of oxygen-demanding substrates. Values below 5 mg/l were observed only in Dogwood and Dry creeks, both tributaries of Mill Creek. Project area stream waters are colored by tannins and lignins from the woody and leafy debris that is present, a condition common in woodland streams throughout the southeastern U. S. While turbidities were generally low in headwater reaches, the main streams and some tributaries (e.g., Dogwood Creek) were quite turbid.

6.7.1.2 Aquatic Biota. The spring phytoplankton community in Mill Creek was of relatively low density, but moderate diversity (22 to 29 species per station). The Chlorophyta (green algae) and the Cyanobacteria (blue green-algae) were numerically dominant. In terms of numbers of species, the Chlorophyta and the Bacillariophyta (diatoms) were the most important groups. Samples collected during July from Boggy Branch and Mill Creek showed the Bacillariophyta to account for over half the phytoplankton species present. Because of shading by riparian vegetation and flushing, phytoplankton populations would not be expected to become very dense in these streams, except in pools experiencing very low flows and receiving adequate sunlight.

Zooplankton density was also low, and species numbers were moderate. Communities were dominated by copepods and rotifers in terms of both density and numbers of species. Zooplankton communities, like the phytoplankton, can be expected to be sparse in woodland streams except in pool habitats with suitable water quality and sufficient algal and bacterial food supplies.

Macroinvertebrate densities were modearate to high in project area streams. Diversity and community composition vary widely between stations in relation to the habitat types present. Fine grained substates containing substantial amounts of organic matter tend to support large populations of a few speices of Tubificidae (sludge worms) and Chironomidae (midges). Sandy substrates generally support smaller populations of these species. Where the sediments are not anaerobic, these habitats may also support substantial populations of burrowing mayflies. Riffle areas, with coarser substates and high oxygen concentrations, tend to support a more diverse fauna consisting primarily of caddisflies and stoneflies. Other major invertebrate habitats in project area streams include accumulations of terrestrial detritus and stands of aquatic macrophytes. The former are generally dominated by mayflies, chironomids and odonates (dragonflies) while stands of vegetation generally support diverse and often abundant assemblages of crustacean and insect species because of the relatively abundant food and cover. Although algal grazers and filter feeding macroinvertebrates are important in the riffle habitats, the bulk of invertebrate species and biomass in the project area streams are detritus feeding forms found in and on soft sediments and detrital accumulations.

The largest stream in the project area, Mill Creek, supports the largest and most diverse fish fauna. The abundance and diversity of fish communities in the project area is limited by the small sizes of the streams. Nevertheless, several species in each of the functional groups (e.g., herbivores, detritus feeders, invertebrate predators and piscivores) are present in these drainages. The minnows (Cyprinidae), killifishes (Fundulus spp), and sunfishes (Centrarchidae) are the most abundant and widespread groups in the project area. The fish assemblage is comprised of species exhibiting a variety of habitat preferences which reflects the range of current velocities, substrate types, available cover and other environmental conditions.

The biota of the artificial pond habitats tend to vary widely in response to such factors as size, depth, water quality and management. The ponds typically have plankton based food chains. Dominant phytoplankton groups change seasonally and usually include green algae, diatoms and bluegreen algae. Zooplankton communities are usually dominated by crustaceans, although heavy predation by fish may cause a shift to rotifer dominance. Crustaceans also tend to be important in the macro-invertebrate community, but large populations of oligochaetes and chirononids may be expected where the sediments contain sufficient organic matter. Fish assemblages in ponds are often the result of stocking activities. Largemouth bass, several sunfish species and channel catfish are among the most commonly stocked species.

6.7.1.3 Important Species.

Important species were defined in Sec. 6.6.1.3.

Recreationally or Commercially Important Species. Aquatic habitats of the study area are too small to sustain any commercial fishery. There was evidence at station MC3 (Mill Creek) and the Cannon Stock Tank that these areas were used for a recreational fishery.

However, these areas are of limited value: (1) because of the small size and physical access limitation at station MC3; and (2) because the Cannon Stock Tank is privately owned (limited access). Potentially important recreational species on the project site would include the largemouth bass, channel catfish, black bullhead, yellow bullhead, grass pickeral and various sunfish.

Other Important Species. There are no species found in the waters of the project area that fall under criteria (c) or (d). Based upon the survey results, the most common forage fish species on the site appear to be minnows (Cyprinidae), topminnows (Cyprinodontidae), and sunfish (Centrarchidae). The primary food base of project area streams is detrital and a variety of species representing numerous insect, crustacean and annelid orders are important in converting this material into animal biomass.

6.7.2 Impacts of No Action Alternative

With the no action alternative, the minor adverse impacts to aquatic habitats expected to occur are associated with agricultural activity and increased population growth in the area.

6.7.3 Impacts of Project Alternatives

Potential impacts to the streams in the Martin Lake "D" Area could result from channel disturbance; increased nutrient loading during initial clearing of vegetation (Secs. 6.5.3 and 6.6.3.1); increased loading by suspended solids during clearing and by runoff from roadways, vehicle maintenance areas, other support facilities and mining operations (Sec. 6.5.3); changes in hydrologic regime due both to the operation of runoff control structures and to changes in ground-water recharge regimes (Sec. 6.4.3); and as a result of the loss of riparian vegetation in some stream reaches (Sec. 6.5.3).

The only planned channel disturbance would take place in the initial five-year permit area where approximately 2,000 feet of Dry Creek would be temporarily diverted and realigned. Species diversity in this stream is quite low (EH&A, 1981c) due to its small size and poor water quality. The resident aquatic organisms in the approximately 2,000 feet of Dry Creek to be diverted would be eliminated. Aquatic organisms that have colonized the temporary realignment would also be eliminated when the stream is returned to its approximately original configuration.

Since the disturbed reach is relatively short (0.38 mile) and would remain in contact with habitats up and down stream, recruitment of colonizing organisms would not be restricted. Recolonization in the disturbed reach would proceed in a manner similar to what now occurs following a flood event that results in a scoured channel. Plants and invertebrates would be transported into the disturbed reach as drift from upstream areas and by active and passive overland transport. The fish have sufficient mobility to reach the disturbed area from either upstream or downstream.

Algal and invertebrate recolonization would be expected to proceed very rapidly. Depending on season, substantial algal growth could be expected to occur within weeks. Riffle fauna, primarily algal grazers and filter feeders, could be expected to recolonize with similar rapidity as their food sources develop. Invertebrates characteristic of organically rich, fine-grained sediments and those preferring vegetated habitats would be restricted in density until substantial organic matter has accumulated and aquatic macrophyte growth has occured.

As a result of mining operations, the riparian cover would be removed from the diverted reach of Dry Creek and minor headwater streams. Assuming that sufficient water were present in this areas, increases (over present levels) in algal and aquatic macrophyte production would be expected. This, coupled with the loss of detrital input from the riparian vegetation, would result in a shift from a detrital based food web to one dependent on plant production within the stream. While some changes in the species composition of both producer and consumer communities could be expected, no reduction in living biomass, species diversity or productivity should occur.

Utilization of the disturbed reach would be almost immediate, but development of resident populations by fish species would follow the development of the algal and invertebrate food base and the cover provided by the development of aquatic macrophytes. The diversion of part of Dry Creek represents short-term, significant, adverse impacts to the aquatic ecosystem in this localized area.

Clearing of forest vegetation is known to have a potential for releasing nutrients from litter and exposed soil. Fertilization during revegetation activities could add further nutrients to project area streams. These increases in nutrient load following land clearing and during reclamation would occur as a series of short-term events. The intensity of each event would depend primarily on the amount, timing and duration of precipitation, and on the proportion of the drainage area affected, proximity of disturbed areas to the stream channel, and the operation of control structures. If algal growth is limited by nutrient availability, rather than by shading or high flow rates, increased nutrients can increase algal growth. Substantial algal growth in streams is generally limited to low flow periods when flushing rates are low and to locations where sufficient light is available. High algal densities are commonly encountered in sunlit pools during summer low flow conditions. This may stress fish populations by nighttime oxygen depletion and daytime supersaturation. Heavy growth of filamentous algae in sunlit riffles could result in an altered species composition and increased invertebrate biomass in that habitat. Impacts to area streams from this source would be limited to short periods of time, and be restricted to areas having the right combination of flow, substrate and sunlight to support substantial algal growth. No significant impacts to undisturbed channel reaches should occur from nutrient loading.

Large, persistent increases in sedimentation rates can cause extensive habitat degradation by blanketing hard substrates, smothering vegetation and aquatic animals, filling pools and resulting in a stream bed so unstable and rapidly accumulating that plant and animal colonization cannot keep up. On the short-term, State and Federal regulations should prohibit the extremely poor land management practices that would cause that situation. The degree and duration of impacts to aquatic communities from increased suspended solids loading are dependent on: (1) the amount of suspended material delivered to the stream; (2) the amount deposited on the substrate; (3) the nature of the substrate and resident biota; and (4) the availability of high flows to scour blanketed substrates. Sedimentation is not expected to result in significant adverse impacts to most of the stream channels draining mine areas. These channels already consist of fine-grained sediments and are inhabited by species adapted to that type of environment. Sedimentation on fine-grained substrates, if heavy enough, could result in smothering some of the resident organisms. Adaptation to habitats characterized by soft sediments includes mechanisms providing for rapid recolonization of areas disturbed by high flow events where existing substrates are moved downstream during a flood and "new" material, from both upstream and surrounding terrestrial areas, is deposited when water levels fall.

Riffle areas, characterized by more rapid flow, and gravel or rocky substrates occur at scattered locations, primarily in the upper reaches of the larger streams such as Mill Creek. Impacts from sedimentation would be more severe in these areas if the hard substrates were blanketed by fine grained materials. Substantial substrate blanketing eliminates the hard substrate utilized for attachment or cover by riffle species, and will result in their replacement by assemblages typical of fine-grained habitats until the sediments are scoured from the substrate during subsequent high flow events. Depending on the amount of material deposited and the hydrologic regime at a particular location, substrate cleaning following sedimentation could occur on a time scale of days to (in very extreme cases) years.

Increases in suspended solids in the water column would not affect the food base of area streams since these water bodies are characterized by detrital rather than plankton or periphyton based food chains. The upper reaches of the stream receive large amounts of debris from riparian vegetation while the emergent vegetation of the marshy areas, along the lower reaches, contributes substantial litter (EH&A, 1981c). This is a typical condition in woodland streams with predominately fine grained substrates (Whitton, 1975). Suspended solids concentrations, stipulated by NPDES limitations, would not cause significant blanketing of stream substrates unless an unpredictable event, such as heavy rainfall during sediment pond construction, occurs.

Alterations of stream hydrologic regimes would result from the operation of sedimentation ponds, other runoff control structures, and perhaps from changes in the pattern of ground-water recharge to the stream channels. Operation of the surface water control structures would slightly retard runoff, allowing surface waters to enter the stream channels over a longer period of time. Since the small streams of the region typically experience relatively long periods of little or no flow any extension of the proportion of time during which streamflow occurs can be regarded as a beneficial impact particularly in pool habitats and vegetated areas. Retention of flood peaks would tend to reduce scour in riffle areas and could result in some sediment build up in those areas, or in an inability to rapidly clean riffles that might be heavily blanketed. This would be a significant, adverse impact to riffle habitats and the rather specialized fauna found there. Hydrologic modeling (Sec. 6.4.3.1) shows that the reductions of flood peaks would generally be small (less than 5 percent) and flood peaks would return to an equal or slightly greater level under post-mining conditions.

While operation of the sedimentation control structures would act to extend the period of flow in area streams, disruption of shallow aquifers during mining would tend to reduce the amount of ground water entering those channels. While the ground-water contribution to stream flow is unknown, it can be assumed that it constitutes a substantial proportion of the base flows that remain during dry periods. The most probable net effect of the two impacts would be to cause the headwater reaches to be more intermittent but to ensure more continuous flow in the lower reaches of the larger streams. Since the majority of species (including most of the fish) and the largest biomass occur in the lower, more permanent, stream reaches, overall adverse impacts are expected to be minor.

Hydrological modeling results (Table 6-14) indicate that stream runoff patterns following reclamation would not be significantly different from the premining condition. It is anticipated that some of the sedimentation ponds would be left in place as permanent impoundments (Sec. 6.4.3.3), providing refuges for selected aquatic species during drought conditions. No significant long-term adverse impacts to aquatic communities are expected to result from altered hydrologic regimes.

6.8 THREATENED OR ENDANGERED SPECIES

6.8.1 Existing Environment

The Red-cockaded Woodpecker, Bald Eagle and American Alligator were listed as the species of potential occurrence by the FWS (letter dated November 30, 1981). A Biological Assessment of the project area was conducted to determine the effects on listed species (see Appendix K for details).

6.8.2 Impacts of No Action Alternative

Lack of evidence of the presence of any of the three species in the project area indicates the no action alternative would have no adverse impacts on these species.

6.8.3 Impacts of Project Alternatives

In a letter dated July 14, 1982, EPA forwarded to the FWS a biological assessment that had been conducted and stated, "EPA, Region 6, has determined that no effect should occur on the Red-cockaded Woodpecker, American Alligator or Bald Eagle from the Martin Lake 'D' surface mine proposed near Henderson, Texas." The FWS responded in a letter dated September 13, 1982 and stated concurrence with EPA's determination.

6.9 ARCHAEOLOGICAL AND HISTORICAL RESOURCES

6.9.1 Existing Environment

6.9.1.1 Cultural Background. The cultural history of northeastern Texas may be divided into three prehistoric and one historic temporal sequences: Paleo-Indian, Archaic, Neo-American and Historic. The prehistoric sequences reflect changes in subsistence as exhibited by material remains and settlement patterns.

Paleo-Indian. The known prehistory of the project area commences with the Paleo-Indian period, beginning prior to 8,000 B.C. and continuing to 6,000 B.C. Diagnostic traits include a variety of finely chipped, sometimes fluted, lanceolate projectile points. No stratified or intact Paleo-Indian sites have been recorded in this region of northeast Texas; however, surface finds of Clovis, Angostura, Plainview and Meserve dart points have been recovered. These finds are usually restricted to upland terraces (Jackson et al., 1978). Isolated finds of these points may indicate the presence of Paleo-Indian hunters from the southern Plains who entered this region in pursuit of bison that were in the area between 10,000 and 6,000 B.C. (Dillehay, 1974).

Archaic. The Archaic Period is indicated by cultural materials from the La Harpe Aspect (ca 6,000 B.C. to 500 A.D.) in this area. The subsistence pattern during this period shifted from a big game hunting economy to one based on hunting and gathering. Earlier studies (Richner and Lee, 1976; Anderson, 1974; Prewitt, 1974) indicate a pattern of central-based wandering with primary utilization of first river terraces as base camps with small stream drainages utilized for short-term seasonal hunting or collecting. Diagnostic traits of the early phase of the La Harpe Aspect are flexed burials, pitted manos and expanding stemmed dart points (Yarbrough, Trinity and Palmillas), often of exotic materials; followed by contracting stemmed Gary dart points in the later phase of the Aspect. Sites of the final phase of the La Harpe Aspect, termed the Bookland Focus (Jelks, 1965), contain plain sandy paste Williams Plain ceramics (Johnson, 1962).

Neo-American. The Neo-American or Late Prehistoric Period is represented in the project area by the western periphery of the Caddoan culture. Beginning about 700 A.D., it lasted until the formation of the Republic of Texas in the 19th century (McLure and Howe, 1937). Caddoan prehistory is divided into the Gibson and Fulton aspects, and into locational or chronological foci. Local remains from the Gibson Aspect have been identified as Alto and Sanders foci, while the subdivisions of the Fulton Aspect are Whelan, Titus, Kinsloe and Allen foci. The Caddo lived in hamlets, often associated with ceremonial centers. The subsistence pattern was agricultural with such crops as corn, beans and squash. The beginning of agriculture usually coincides with two additions to artifact assemblages: the bow and arrow; and ceramic vessels.

Diagnostic traits of the Alto Focus include extended burials with grave goods, Alba arrowpoints, Gary dart points and plain, engraved or incised clay tempered pottery (Suhm et al., 1954). The Whelan Focus is distinguished by a reduction in the size of ceremonial centers and population dispersal from large river valleys to smaller streams. Typical diagnostic artifacts include Ripley and Taylor Engraved wares, Bullard, Brushed, Maydelle and Pease incised ceramics, and Alba arrowpoints. The Titus Focus (the last prehistoric Caddoan sequence) exhibited extended burials with grave goods, Widler, Ripley and Bailey Engraved clay-grit tempered ceramics and Talco, Maud and Bassett arrowpoints. Cemeteries are found on terraces and uplands, out of the valley floors.

Historic. European contact with the Caddoans first occurred in 1541 A.D. with the explorations of DeSoto (Newcomb, 1961). In the 1600s the European contact was made with Caddoans in the area of the Allen and Kinsloe foci as is indicated by the appearance of European trade goods among the artifact inventory associated with Womack and Natchitoches Engraved, Hudson and Nacona Plain and Emory Punctated ceramics. Shell tempering became more common during this period (Davis, 1970). Later, Cherokee and Shawnee Indians, driven from their villages in the east, settled in the area and under the leadership of Chief Bowles, they named the local streams and villages. In the 1820s, American settlers moved into the region and Indian removal followed Texas independence in 1836.

Rusk County was formed when it separated from Nacogdoches County in 1843 with Henderson as the county seat. In 1846, Rusk County sent a company of mounted volunteer riflemen to participate in the Mexican War. "Wire Road" traversed the county from northeast to southwest and passed through the proposed project area. It was a stagecoach route carrying passengers and freight from Marshall and Jefferson to Crockett and points south and west and became the route of one of the earliest telegraph lines in 1854. During the Civil War, Rusk County supported the Confederacy. Presently, the county ranks high in the production of oil, iron ores, brick clay and lignite (Webb, 1952).

6.9.1.2 Project Specific Surveys

Mine. A reconnaissance survey conducted within the mine boundaries in 1980 located five cultural resources sites: two prehistoric (41RK82 and 41RK83) and three historic (41RK85, 41RK86 and 41RK87). These sites have been recommended for further testing to determine their eligibility for inclusion on the National Register of Historic Places (NRHP) (Table 6-18) (Moncure and Jackson, 1980). Recent work on site 41RK87 has shown that further testing of it is unnecessary (Jackson, 1982).

An intensive survey of 6,500 ac (the First Five-Year Permit Area) located 22 cultural resources sites, including: 3 prehistoric sites, 14 standing structures and 5 other historic sites. Three prehistoric sites (41RK109, 41RK110 and 41RK111) are recommended for additional testing to determine their eligibility for inclusion on the NRHP (Table 6-18). Two historic sites (both cemeteries) 41RK120 and 41RK124 are recommended for avoidance (Table 6-18). One historic standing structure, site 41RK115, is recommended for preservation or documentation should mining operations appear to have an adverse impact on the property (Jackson, 1982). No sites presently listed on the NRHP exist within the project boundaries.

The intensive survey of 6,500 acres covered approximately 36 percent of the total mine area. Surveys of the remaining 64 percent could reveal the location of additional cultural resources sites, of which some 20 sites are predicted to be eligible for inclusion on the NRHP (Moncure and Jackson, 1980).

Railroad and Transmission Line. In 1982, an intensive survey was conducted on the railroad and transmission line rights-of-way. No cultural resources sites were located within the transmission line corridor. One site, 41RK104 the Walling Cabin, was located within the railroad corridor (Table 6-18) (Moncure and Jackson, 1982a). This site has been determined eligible for inclusion on the NRHP.

6.9.1.3 General Surveys. Until recently, archaeological investigations in the project area have been limited. In 1912, Clarence B. Moore highlighted the cultural resources of East Texas and Louisiana (Moore, 1912). Beginning in the 1930s, Jack T. Hughes compiled a catalogue of East Texas sites, recording the general location of 27 sites in Rusk County (Hughes, 1948). While gathering data for his Master's Thesis, Calvin Jones examined Caddoan pottery recovered from a site in Rusk County (Jones, 1968). In the early 1970s, Dr. Georgeanna Greer investigated and recorded 12 early Texas pottery kilns in Rusk

TABLE 6-18

SITES RECOMMENDED FOR FURTHER WORK

Site No.	Site Name	Survey/ Reference	Cultural Affiliation	Recommendation
41RK82	Unnamed	TAS 1980	Prehistoric	Test
41RK83	Unnamed	TAS 1980	Prehistoric	Test
41RK85	Millville Cemetery	TAS 1980	Historic	Avoidance
41RK86	Town of Millville	TAS 1980	Historic	Survey and subsurface testing and avoidance
41RK104	Walling Cabin	TAS 1982a	Historic	Determined eligible for NRHP (6/82)
41RK106	Unnamed	TAS 1980	Prehistoric	Test
41RK109	Unnamed	TAS 1982b	Prehistoric	Test
41RK110	Unnamed	TAS 1982b	Prehistoric	Test
41RK111	Unnamed	TAS 1982b	Prehistoric	Test
41RK115	McLemore-Williams House	TAS 1982b	Historic	Preservation or documentation if to be mined
41RK120	New Hope Cemetery	TAS 1982b	Historic	Avoidance
41RK124	Mt. Vernon Baptist Cemetery	TAS 1982b	Historic	Avoidance

County. One, the Taylor Brown pottery kiln, is located near the project area (Greer, 1973). In 1972, prior to the construction of Martin Creek Dam, the Texas Archeological Survey (TAS) recorded 41 sites during an intensive archaeological survey of the MLSES and mining areas in Rusk and Panola counties (McDonald, 1972; Clark, 1972). Site 41RK10, located within the MLSES site near the terminous of the railroad spur, was not recommended for futher study. Due to construction of the MLSES and associated facilities, no evidence of this site presently remains. In 1972 and 1973, John Clark and James Ivey conducted archaeological and historical investigations in the Martin Lake area, excavating five prehistoric sites located during the 1972 survey and examining historic records from the time of initial European contact (Clark and Ivey, 1974).

6.9.1.4 Prehistoric Properties.

Site 41RK82 is located in the bottomland on the west side of Mill Creek. The extent of the site is undetermined. Cultural materials collected include four types of ceramic sherds, 21 lithics and 5 unfired clay lumps, indicating a Neo-American cultural affiliation. Testing has been recommended to determine National Register eligibility (Moncure and Jackson, 1980).

Site 41RK83 is located north of the confluence of Mill and Dogwood creeks on the west side of Mill Creek. It is situated on an erosional remnant above the bottomland. Cultural materials collected include four types of decorated ceramic sherds, one complete projectile point and a point tip, indicating Neo-American cultural affiliation. The archaeological potential, structural integrity and degree of preservation can only be determined by subsurface testing (Moncure and Jackson, 1980).

Site 41RK106 is located on the first terrace of Mill Creek on the east bank at the end of a dirt road which commences at FM 782. Cultural materials recovered from the surface include: a grinding stone, decorated ceramic sherds, lithic debitage and unfired clay lumps. Testing is recommended to determine the extent of this site and its affiliation with sites 41RK109, 41RK110 and 41RK111 (Jackson, 1982).

Site 41RK109 is located west of 41RK106 on a low erosional remnant knoll overlooking the flood plain of Mill Creek. Shovel probes revealed the base of a small Gary-type dart point, lithic debitage, ceramic sherds and possibly the floor of a dwelling. The site extends over an oval area 165 x 100 ft. Testing is recommended to determine structural integrity, National Register significance and to determine possible continuity with sites 41RK106, 41RK110 and 41RK111 (Jackson, 1982).

Site 41RK110 is located about 1,150 ft south of 41RK109 on an erosional remnant overlooking the flood plain of Mill Creek. Cultural materials were recovered from subsurface probes at depths ranging from 7 to 16 in. and included a small Gary-Elam-type point, an incised ceramic sherd and lithic debitage. The site extended in an oval 100 x 66 ft. Testing is recommended to determine significance according to National Register criteria and to disclose possible continuity with sites 41RK106, 41RK109 and 41RK111 (Jackson, 1982).

Site 41RK111 is located 1,150 ft south of 41RK110 on an erosional remnant above the flood plain of Mill Creek. No cultural materials were recovered from the surface; however, subsurface shovel probes uncovered lithic debitage similar to that recovered from 41RK109 and 41RK110. The site boundary determined by shovel probes is a roughly circular area 200 ft in diameter. Testing is recommended to disclose possible continuity with sites 41RK106, 41RK109 and 41RK110, and to determine significance according to National Register criteria (Jackson, 1982).

6.9.1.5 Historic Properties

Site 41RK85 is the Millville cemetery which has been in use since the 1840s. It is situated behind the present day Millville Baptist Church. The land was legally deeded to public use as a cemetery by San Jacinto veteran Jesse Walling and, therefore, must be avoided or dealt with according to Vernon's Annotated Revised Civil Statutes of the State of Texas Title 26, Articles 912a-10 and 912a-11 (Moncure and Jackson, 1980).

Site 41RK86 the Town of Millville, is about nine miles north of Henderson to the east side of FM 782, across from a cemetery and church. The town was called Liberty Hill during the 1840s. Old foundations, roadways and drainages and records searches indicate a town of moderate size. The main road was the "wire road." The remains of this nineteenth century town have not been overlain by modern construction and, therefore, have the potential to contribute historical information of a discrete, clearly limited time period. Survey and subsurface testing, as well as avoidance, have been recommended as mitigative measures at this site (Moncure and Jackson, 1980).

Site 41RK104 the Walling Cabin was located three-quarters of a mile east of State Highway 43 on an unmarked dirt road situated between Wright and Wasson branches, entirely within the proposed railroad corridor. The site exhibited a single pen log cabin (with additions and alterations), a well or artificial depression (possibly a root cellar) and a second depression which may be the remains of a well or a privy. The cabin was removed from the site and a detailed site survey was conducted (Sec. 6.9.3).

The cabin is significant, under three criteria stated in CFR36 Part 800, for the historic data that it provides. It was erected in 1841 by the original land grantee, Thomas Jefferson Walling, who was also important in Texas Republic history. The Walling Cabin is considered an excellent example of early pioneer vernacular architecture of east Texas. It is the only known structure of this type surviving in Rusk County and as such has been determined eligible for inclusion on the NRHP.

Site 41RK115, McLemore-Williams House, is located on the east side of FM 782 across from the New Hope Church. The house was constructed between 1895 and 1905. It is a traditional Anglo center hall house with a "T" shaped floor plan with a broad veranda across the front and on the rear kitchen wing. The structure does not merit National Register nomination, however, if future mining plans appear to affect the property preservation or more complete documentation of the structure is recommended to provide information pertinent to the history of Rusk County (Jackson, 1982).

Site 41RK120, New Hope Church and Cemetery, is located on Highway 782. A church building and school house occupied the property prior to 1901 (Deed book 47, page 601). In accordance with guidelines established for cemeteries in Vernon's Annotated Revised Civil Statutes of the State of Texas Title 26, Articles 912a-10 and 912a-11, avoidance of this site is recommended (Jackson, 1982).

Site 41RK124, Mt. Vernon Baptist Church and Cemetery, is located north of Hwy 43 3.5 miles from Henderson. Constructed about 1932, it was recorded as an archaeological site for archival purposes. In 1922, A. W. Prior donated one acre of land 1,300 ft north of the church to be used for a cemetery (Deed book 119, page 11). In accordance with guidelines established for cemeteries in Vernon's Annotated Revised Civil Statutes of the State of Texas Title 26, Articles 912a-10 and 912a-11, avoidance of this site is recommended (Jackson, 1982).

Other Historic Sites. Other historic plantation sites have been reported from the area but have not been surveyed. The John Vinson, Sr. plantation may fall within the project boundary. The house, a single-story classic Anglo center-hall house, is still standing but not in good repair. Part of the original Richard McGee plantation may be within the project boundary. Much of the original tract has been extensively disturbed and the exact location of the plantation house is unknown. No identifiable remains of this plantation could be located in areas which were surveyed (Jackson, 1982).

6.9.2 Impacts of No Action Alternative

Under the "no action" alternative, some archaeological or historical resources in the project area might be adversely affected by local collections, agricultural or other activities, and further natural weathering. These impacts would occur at approximately the same rate as in the past.

6.9.3 Impacts of Project Alternatives

6.9.3.1 National Register Sites. In considering the issuance of an NPDES permit (as well as in some other agency actions), EPA must comply with Section 106 of the National Historic Preservation Act (the Act and Sections 1(3) and 2(b) of Executive Order 11593. The Act established measures for identifying, assisting and protecting historic properties worthy of preservation. Identification (the NRHP) and assistance (grants-in-aid) are the responsibility of the Department of the Interior. Protection is the responsibility of all Federal agencies. One requirement in meeting the intent of Section 106 is maximum coordination with the environmental review process established by NEPA. The Advisory Council on Historic Preservation (Council) oversees the protective features of Section 106. Section 106 applies to properties eligible for, as well as those listed in, the NRHP. Identification of all such properties on a project site is called for before a permit is issued. A determination of effect must be made concerning these properties. Effect is measured against the characteristics that qualify the property for the Register and may be direct or indirect and beneficial or adverse.

Based on completed survey findings, EPA determined that in the project mine area register eligible cultural resources do exist and, based on the nature of the project activities, will be adversely affected. Adverse effects from mining and construction expected include: destruction or alteration of all or a part of properties; isolation from or alteration of the environment surrounding a property; introduction of elements that are out of character or alteration of setting.

The Walling Cabin was determined eligible for the NRHP in June 1982 by the Keeper of the Register after submitted as eligible by EPA with concurrence of the State Historic Preservation Officer. Mitigation to destruction of the cabin required by EPA and the Texas SHPO included: a complete archaeological survey of the site; detailed drawings and photographs keyed to an accurate topographic map of the site; metal and non-metal objects survey with appropriate mapping; some hand and mechanical excavation. These measures were to be completed by September, 1982 to meet EPA requirements before any clearing on the railroad corridor. The drawings and report are to be filed with the National Architectural and Engineering Record of the National Park Service. Other measures taken by TUGCO include transfer of ownership of Walling Cabin to Rusk County Historical Commission and dismantling and relocation of the cabin logs, foundation stones, associated artifacts, etc., to a site in Henderson for storage. The Rusk County Historical Commission is undertaking restoration of the cabin for use as an educational display; funds for its completion must come largely from group's and individual's donations to the Commission. The Keeper of the Register recommended nomination to the NRHP when restoration is complete. The removal of the cabin from its original, remote and undeveloped setting constitute an adverse effect under Criterion 3 of the Council's criteria for determining adverse effect (CFR 36 Part 800); however, mitigative measures have minimized the adverse impact. When restoration is completed, the overall impact on the cabin, as a result of this project, may be beneficial. The cabin site, however, has been cleared and leveled and irretrievably lost for further study when techniques may be advanced.

One historic and six prehistoric sites recorded during the initial surveys of the project area have been recommended for further testing to determine their eligibility for the NRHP (Table 6-18). The Memorandum of Agreement developed during consultation (Sec. 6.9.3.3) addresses the elements necessary for the detection and handling of cultural resources during the life of the project. Further testing of these and any other appropriate sites which might be detected during future surveys will be conducted according to those elements. A determination of effect will be made for each eligible site at the appropriate time. Sites 41RK106, 41RK109, 41RK110 and 41RK111 occur in the first five-year permit area. These sites should be tested soon, eligibility determined and the effect assessed. The applicant is to provide complete documentation of haul road construction and transmission line relocations for a determination of effect. If any of these sites is eligible and affected, mitigation is likely.

6.9.3.2 Sites Not Eligible for the NRHP. Certain sites not eligible for the NRHP, such as cemeteries, are provided protection by other state or Federal laws. According to RRC regulations, a 100-foot buffer zone must be maintained between mining operations and any cemetery. Thus, avoidance, as recommended for those sites on Table 6-18, is assumed by RRC regulations. Other cultural resource sites not listed or eligible for listing on the NRHP may not be protected by state or Federal laws. EPA considers that the proposed project would cause a significant adverse impact to such sites since disturbance of them would constitute an irretrievable loss for potential study and analysis under future advanced technology.

6.9.3.3 Agreement for Consideration of Cultural Resources. Formal consultation among EPA, the Texas State Historic Preservation Officer and the Advisory Council on Historic Preservation, which included review by TUGCO as an invited non-Federal party, was carried out when the determination of adverse effect was made by EPA. In lieu of requiring identification of properties on the entire project area and mitigation of adverse impacts before issuance of a permit, elements necessary to provide for cultural resources detection and/or handling for the life of the mine were agreed upon and included in a Memorandum of Agreement (MOA) (Appendix B). Any permit issued for the project will have a provision that stipulations of the MOA will be met by the permittee. The MOA constitutes the comments of the Advisory Council on Historic Preservation for the life of the project - provided the stipulations are met. Should EPA be notified by any of the consulting parties, or other party, that stipulations are not being met, it may be necessary to reenter into formal consultation or terminate the permit.

6.10 AIR AND SOUND QUALITY

6.10.1 Existing Environment

6.10.1.1 Air Quality. The climate of the project area may be characterized by the following general statements (U. S. Dept. of Commerce, 1968a; Radian, 1980; Holzworth, 1974):

(1) The climate is classified as humid subtropical, with warm summers and mild winters.

(2) The annual average temperature at Henderson is 66°F.

(3) The annual average precipitation rate at Henderson is 46 inches.

(4) The most frequent annual wind directions at Mill Creek monitoring station are south and south-southeast (12.5 and 11.9 percent, respectively).

(5) The average annual wind speed at Mill Creek monitoring station is 5.8 mph.

The air quality in the project area is very acceptable. The project is located within Air Quality Control Region (AQCR) 022. The EPA has designated Gregg County, Texas, and Caddo and Bossier parishes, Louisiana as nonattainment (i.e., having monitored air quality that is not within acceptable standards) for ozone. Standards for all remaining criteria pollutants are either being attained (being met) in AQCR 022, or there are insufficient data available to designate an attainment or nonattainment status.

Air quality monitoring data were collected at the TUSI Mill Creek monitoring station during the period April 1979-April 1980. In addition, the Texas Air Control Board (TACB) operates a nearby monitoring site at Longview. Table 6-19 presents a summary of these data for total suspended particulates (TSP), sulfur dioxide (SO_2) nitrogen dioxide (NO_2), and ozone, and also includes the appropriate National Ambient Air Quality Standards (NAAQS). The only exceedances of any NAAQS occurred at Longview, where the ozone standard has been consistently violated. The only pollutant expected to be emitted in significant quantities by the mining activity would be TSP. No exceedances of the TSP NAAQS have occurred at either Mill Creek or Longview.

6.10.1.2 Sound Quality. A baseline sound level assessment of the project area was conducted by EH&A in 1981 using a GenRad sound-level meter and associated equipment. Seventeen receptor locations were selected to represent various types of noise-sensitive land-use areas where ambient sound levels could be affected by the proposed project. Figure 6-16 shows each baseline receptor location's relative position with respect to the proposed mine. These receptors include five churches (receptors 11, 14, 15, 16, 17), five rural residences (receptors 1, 4, 7, 8, 10), two communities (receptors 3, 13), and two schools (receptors 13, 14).

Due to the predominantly rural nature of the study area, natural noises (i.e., bird and insect activity) are the dominant source. This is reflected by higher nighttime sound levels, caused primarily by heavy nocturnal insect activity. Day-night noise levels at all

TABLE 6-19
MONITORING DATA SUMMARY

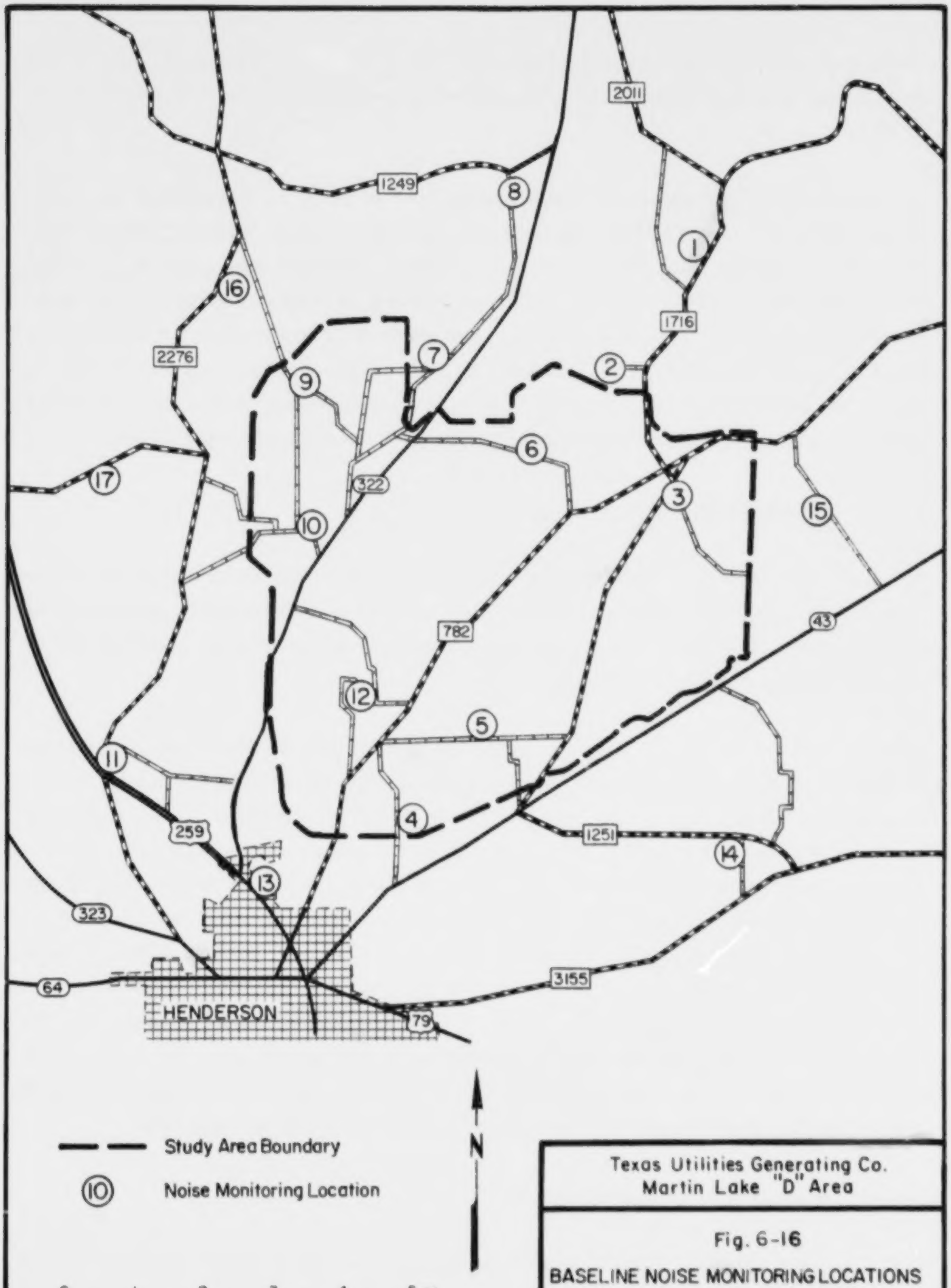
Monitor Location	Period	TSP Annual Geometric Mean ($\mu g/m^3$)	TSP 24-Hour 2nd Highest ($\mu g/m^3$)	SO_2 Annual Arithmetic Mean (ppm)	SO_2 24-Hour 2nd Highest (ppm)	SO_2 3-Hour 2nd Highest (ppm)	NO_2 Annual Arithmetic Mean (ppm)	O_3 2nd Highest Hour (ppm)
Mill Creek	4/79-4/80	28.7	112	0.001	0.03	0.10	0.004	-
Longview	1978	34^1	63	0.00	0.00	0.02	-	0.12
	1979	33	72	0.00	0.00	0.04	0.01	0.14
	1980	34	72	0.00	0.01	0.10	0.01	0.13
NAAQS		75^2 60^3	260^2 150^3	0.03^2	0.14^2	0.50^3	0.05^2	0.12^2

[1] Insufficient sampling data for statistically valid mean.

[2] Primary standard - Designed to protect the public health.

[3] Secondary Standard - Designed to protect the public welfare.

Sources: TACB (1978a, 1978b, 1979a, 1979b, 1980a, 1980b); Radian (1980).



SOURCE: EH&A 1981

Texas Utilities Generating Co.
Martin Lake "D" Area

Fig. 6-16

BASELINE NOISE MONITORING LOCATIONS

monitoring locations were found to range from 56 to 60 dBA, with the majority of the project area expected to have a baseline ambient day-night noise level of approximately 58 dBA.

As directed by Congress in the Noise Control Act of 1972, as amended by the Quiet Communities Act of 1978, EPA has developed appropriate noise level guidelines. EPA generally recognizes rural areas to have an average day-night noise level (L_{dn}) of less than 50 dBA (EPA, 1978). Average outdoor noise levels in excess of 55 dBA for 24 hours are considered annoying for some persons, while levels of 70 dBA or more for 24 hours can result in hearing loss (EPA, 1974). For housing, HUD considers outdoor L_{dn}'s of 65 dBA or less to be "acceptable." Levels above 65 dBA, but not exceeding 75 dBA, are considered "normally unacceptable," and levels above 75 dBA are "unacceptable" (HUD, 1980).

6.10.2 Impacts of No Action Alternative

6.10.2.1 Air Quality. With the possible exception of future construction and operation of nearby facilities proposing to emit large quantities of atmospheric pollutants, the project area's air quality would remain unchanged from its present condition if the proposed project were not constructed.

6.10.2.2 Sound Quality. Based on projected and current population information for Gregg, Harrison, Panola and Rusk counties, ambient sound levels were estimated for the year 2000, assuming a no action alternative. Day-night noise levels (L_{dn}) for rural areas can be computed (National Research Council, 1977) using census tract data and the formula $L_{dn} = 10 \log \rho + 22$db, where ρ is the population per square mile. Each of the counties and their corresponding L_{dn} increase from 1980 to 2000 were found to be: Gregg, 1.5 dBA; Harrison, 0.6 dBA; Panola, 1.5 dBA; and Rusk, 1.2 dBA. These increases in L_{dn} reflect only general activities from the counties' inhabitants. In association with the increases in county populations, higher traffic volumes will be evident, with a 1 to 2 dBA increase in highway noise anticipated along the area's major highways. With the no action alternative, the area's baseline ambient day-night noise level of 58 dBA could be expected to increase to 60 or 62 dBA by the year 2000.

6.10.3 Impacts of Project Alternatives

6.10.3.1 Air Quality. Some fugitive particulate emissions would be produced by construction of mine support facilities. Any adverse air quality impacts would be temporary and localized, and particulate levels would only occasionally exceed normal background levels as a result of facility construction. All marketable timber or wood products would be sold while only unmarketable vegetation would be burned. All controlled vegetation burning would adhere to TACB regulations, which include restrictions on specific factors such as wind speed, time of day, buffer zones, etc.

The operation of the Martin Lake "D" Area lignite mine would cause particulate matter to be emitted into the atmosphere. Annual TSP emission rates have been calculated for each individual source of potential emissions. These sources are categorized as either "process sources" or "fugitive sources." Table 6-20 lists each of the TSP emission sources expected at the mine site by source category (lignite processing, fugitive non-lignite and fugitive lignite), as well as the potential emission rates from each source with and without the application of control technology.

Process emission sources are those associated with the actual preparation of the lignite for power plant consumption. Each of these sources is normally confined to a small area or single point, with emissions exiting from a stack, chimney, vent or similar opening. Included in this source category are the following: (1) haul truck load-out (dumping) of lignite into hopper; (2) feeding of lignite from hopper to crusher; (3) breaking of lignite to specified size in crusher; (4) transfer of crushed lignite to conveyor; (5) conveyor from crusher to surge bin; (6) transfer of lignite from conveyor to silo; and (7) load-out of processed lignite from silo to railcars. Control technology utilized at these emission sources would consist primarily of the application of water sprays (at all points except (6)), which has an accepted efficiency rating of 50 percent. In addition, points (5) and (7) would be enclosed. An enclosure, by itself, has an accepted efficiency rating of 90 percent. In combination with the application of water spray, as that anticipated at point (7), the efficiency rating is 95 percent.

Fugitive emission sources are area-wide sources whose emissions cannot effectively pass through a stack, chimney, vent or similar opening. Examples of this source category are the following: (1) removal of overburden (dragline, scraper, dozers); (2) removal of lignite (backhoe, front-end loader); (3) storage of lignite; (4) wind erosion of exposed areas; (5) haul roads and service roads, and (6) reclamation of exposed areas. Water sprays would be applied to the exposed lignite bed, roads and to the storage pile, and vehicle speeds would be controlled on the roads. The application of these controls would reduce road dust emissions by approximately 50 percent, with a remaining emission rate of 847 TPY.

TABLE 6-20

TSP EMISSION SOURCES AT MARTIN LAKE "D" AREA LIGNITE MINE

Emission Source	Annual Average Uncontrolled Emissions (TPY)	Control Technology	Annual Average Net Emissions (TPY)
Lignite Processing			
1. Truck Load-Out	<0.1	Water Spray	<0.1
2. Hopper to Crusher	<0.1	Water Spray	<0.1
3. Primary Crusher	35	Water Spray	18
4. Crusher to Conveyor	<0.1	Water Spray	<0.1
5. Conveyor	<0.1	Enclosure	<0.1
6. Conveyor to Silo	<0.1	None	<0.1
7. Railcar Loading	<0.1	Enclosure, Water Spray	<0.1
Fugitive Non-Lignite			
1. Dragline	54	None	54
2. Scraper	86	None	86
3. Bulldozer (28 yd^3)	18	None	18
4. Bulldozer (10 yd^3)	7	None	7
5. Bulldozer (5 yd^3)	1	None	1
6. Wind Erosion	172	None	172
7. Haul Road	1,645	Water Spray, Vehicle Speed Control	823
8. Service Road	48	Water Spray, Vehicle Speed Control	24
9. Reclamation	360	None	360
Fugitive Lignite			
1. Backhoe	<0.1	None	<0.1
2. Front-End Loader	<0.1	None	<0.1
3. Storage Pile	0.7	Water Spray	0.1

Sources: Bohn et al. (1978); Cowherd et al. (1979); EPA (1977, 1981); PEDCO (1978).

The project would not adversely impact any PSD (Prevention of Significant Deterioration) Class I areas, the nearest of which is Caney Creek National Wilderness Area in Arkansas approximately 160 miles north-northeast of the project area. An analysis of regional TSP emissions performed for TUSI (Radian, 1979) shows that there are few major (100 TPY or greater) point sources within 30 miles of the project area. The largest TSP point source is the TUGCO MLSES, with an annual emission rate of approximately 13,000 TPY.

The operation of the mine would have an unavoidable but small adverse impact on the local air quality. Particulate matter would be emitted in significant quantities by lignite mining and processing at the mine site. The large majority of these emissions would be fugitive in nature, and would settle from the atmosphere within a short time and distance from their release. The control measures discussed previously would help mitigate the adverse impact of these emissions on the area's atmospheric environment. Occurrences of rainfall would help provide a degree of natural control. Controlled process emissions, mainly from the primary crusher, would amount to approximately 18 TPY with the application of water sprays.

The Federal Clean Air Act of 1977 established a Prevention of Significant Deterioration (PDS) Permit Program designed to limit the deterioration of air quality in clean air areas where NAAQS are being met. The PSD program provides that ambient concentrations of air pollutants will not be allowed to increase more than a designated increment above baseline conditions. New sources with emissions exceeding 250 tons per year (excluding fugitive dust) are required to obtain a PSD permit. The Area "D" train loading facility including crusher will have non-fugitive emissions of 18 tons per year which is less than 250 tons per year and will not require a PSD permit. Future new sources seeking to construct in the area will have to include the Area "D" emissions (including fugitive dust) in their PSD applications to ensure that combined emissions will not exceed allowable increments.

The TACB would require a construction permit for the lignite processing facility prior to the commencement of mining activity, and an operating permit within 60 days after activity began. An RRC permit would be required for the mining operations. It would consist of a brief generic fugitive dust control plan, as well as a short discussion of the climate of the project area.

Fugitive dust from the mine site would occasionally produce a nuisance condition near the mine boundary. Dust particles would settle on vegetation, reducing its attractiveness. Dry, windy conditions could also cause some project-related visibility impairment. Both of these impacts would be confined to the project area and immediate environs only.

The processing and burning of lignite from the "D" Area mine at the MLSES would produce some long-term adverse air quality impacts. The processing of the lignite would produce small amounts of fugitive TSP emissions in the vicinity of the power plant site. The burning of the lignite would produce gases and particulate matter, emitted at stack-top level and dispersed downwind. The present allowable emissions from the MLSES are: 13,006 tons per year of TSP; 154,268 tons per year of SO_2; and 90,008 tons per year of NO_x (EPA, 1980). The "D" Area lignite (Sec. 6.1.1 and Appendix E) is slightly higher in average sulfur content than lignite from Areas "A," "B" and "C" (1.36 percent vs. 0.94 percent), and is lower in ash content (6.87 percent vs. 8.28 percent). Consequently, TSP emissions should be slightly decreased due to the burning of "D" Area lignite. There should be no change in SO_2 emissions, since the scrubbers are designed to handle 10.99 lb SO_2 per milion BTU while the average in "D" Area lignite is 2.66 lb SO_2 per million BTU and the highest value is 10.33 lb SO_2 per million BTU. A secondary long-term, minor, adverse impact would be increased vehicular emissions (CO, etc.) along local highways due to the increase in the local work force during mine operations. Another secondary long-term, but insignificant, adverse impact would be the potential for increased acid deposition (acid rain) as a result of the burning of "D" Area lignite at the MLSES. In Texas, acid rain has not been a major issue in the past, but is becoming an issue of significance. Recent acid deposition monitoring has indicated the presence of slightly acidic precipitation in east Texas. However, as noted previously, although "D" Area lignite is higher in sulfur content than that presently burned at the MLSES, the increased scrubbing capacity of SO_2 at the power plant would prevent an increase in its emissions to the atmosphere. This project should not significantly alter the impact of acid deposition in the region.

Trace amounts of uranium are present in the lignite from the project area, primarily as uranium-238 (U-238) along with some 18 decay series' products. Analyses of the lignite indicate that an average value of 1.2 ppm_w of U-238 is present (Appendix D).

Radon-222 (Rn-222), a decay series radionuclide of U-238, would be released into the atmosphere as a result of mining operations at the proposed mine. Radon-222 is normally emanated continuously from virgin undisturbed topsoil. The amount of Rn-222 emanated is related to the amount of U-238 present in the soil or the near-surface material being evaluated. The emanation rate is also related to the type and form of material. The radon emanation ratio (ratio of escape to production rate) is approximately 15 percent for coal and up to 70 percent for soils (Beck et al., 1980). Other factors which influence the radon emanation rate of materials are moisture content (higher moisture contents reduce emanation) and porosity (the greater the porosity, the more easily radon released at greater depths can reach the surface and be emanated). Soils have been reported to have an average concentration of U-238 of 1.8 ppm_w (NCRP, 1975). The emanation rate of Rn-222 resulting from exposure of lignite seams during mining operations and storage of lignite at an emanation ratio of 15 percent would not be expected to be greatly different than from average soils at an emanation ratio of 70 percent. Therefore, release of RN-222 by the exposed lignite during mining operations is not expected to be significant and would have negligible public health consequences.

The concentrations of U-238, and its associated decay series' radionuclides, vary by both horizontal and vertical locations within overburdens (Rosholt et al., 1966; University of Texas School of Public Health et al., 1982). The actions of mining and land reclamation would have the effect of relocating various layers of overburden material containing different amounts of these radionuclides. The Rn-222 emanation rate from the surface at some locations in the reclaimed mine area would be less than the predisturbed emanation rate, while at other locations in the reclaimed mine area, it would be greater. These changes in the radon emanation rate would be caused by relocating existing pockets of overburden material containing varying contents of radium-226 (Ra-226), the parent nuclide of Rn-222, and by changes in topsoil and overburden porosity.

The processing and burning of the lignite at the MLSES would also release small amounts of U-238 and thorium-232 (Th-232), and some 28 decay series products, to the atmosphere. Evaluations of these radioactive emissions from both lignite- and coal-fired power plants and associated coal and ash storage areas have shown that only small fractions of the existing ambient concentations of airborne radionuclides are contributed by these sources (Beck et al., 1980; University of Texas School of Public Health et al., 1982).

6.10.3.2 Sound Quality. Noise-producing site preparation and construction activities at the proposed lignite mining facility can be categorized into two basic activities:

ancillary facilities construction (i.e., the loading station, fuel facility, shop facilities, erection yards, etc.) and road and railroad construction. The noise-producing operations of each activity are described below. Typical major noise-producing sources and the equivalent sound level contribution (L_{eq}) during each activity are estimated from data published by both the Edison Electric Institute (EEI, 1978) and EH&A (Table 6-21). Sound pressure levels drop off uniformly in all directions as sound travels away from its source. Therefore, all construction noise levels in this analysis are referenced at a distance of 50 feet from the center of each activity. This produces continuity for subsequent calculations and enables representative comparison of different construction activities.

As a "worst-case," it can be assumed that facility, road, railroad and transmission line construction would occur within 1,000 feet of each other and on a 24-hour per day basis. Typically, these activities would be on a much smaller scale, miles apart, and, at most, would occur only 16 hours per day; thus, the actual effects would be considerably less. The equivalent sound levels can then be used to compute a worst-case construction L_{dn} (EEI, 1978) of 94 dBA at a distance of 50 feet.

The area's average ambient baseline of 58 dBA would not significantly alter this construction L_{dn}. Under worst-case conditions, activities including ancillary facilities construction along with road, railroad construction and transmission line would occur occasionally along the perimeter of the mining area. Mining, expected to be the dominant noise activity for the project, is not scheduled to commence until 1985; therefore, construction noise would dominate until 1985.

Based on an average attenuation rate, for point sources, of 6 dBA for each doubling of distance away from the source (EEI, 1978), the combined construction noise levels would be within the EPA immediate goal of 75 dBA beyond 450 feet (EPA, 1977). Typically, structures within 1,000 feet of the noise centers would be on mine leased land. Approximately 500 feet from the noise center, levels of 74 dBA would be evident. This is 1 dBA below the immediate goal. Assuming that road and facilities construction would take place just within the mine boundary, only those receptors immediately along the property line should be subject to any adverse impact. However, railroad construction would occur along SH 43 beyond the southeastern boundary of the mine, affecting the Antioch church and school, along with a few residences. Adverse impacts (annoyance) from increased noise levels would be short term at any one site as work progresses along the rail line.

TABLE 6-21

SOUND LEVEL CONTRIBUTION AT 50 FEET FROM CENTER OF EACH MINING ACTIVITY

Mining Activity	Equivalent Sound Level L_{eq} (dBA)
Ancillary Facilities Construction	84
Road Construction	82
Railroad Construction	84
Transmission Line Construction	78
Timber and Brush Removal	85
Overburden Removal	93
Lignite Mining	
Loading	75[1]
Handling	90
Hauling	80[2]
Spoil Grading and Revegetation	86

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[1] Includes a 15 dBA reduction for pit wall attenuation.

[2] Day-Night Noise Level (L_{dn}).

Indoor noise levels experienced by receptors should be considerably less. Allowing a 24-dBA sound reduction for exterior wall construction with windows closed (EPA, 1978), receptors beyond approximately 1,000 feet would not be affected.

It should be emphasized that the construction L_{dn} of 94 dBA represents a "worst-case" condition, with all operations occurring simultaneously around the clock and centered near the mine's boundary. If construction were confined to daytime hours only, the L_{dn} should be substantially reduced to 86 dBA. This would result in an L_{dn} of 65 dBA by approximately 570 feet from the noise center, well within the mine boundary. Further reduction of impacts should occur when the activities are closer to the mine's center. In this case, no adverse noise impacts are anticipated from construction activities.

Noise-producing operations from the proposed mine can be categorized into four separate activities: timber and brush removal, removal of surface soil and overburden, mining of lignite, and spoil grading and revegetation. These activities can occur simultaneously, but spread out over an area of 60 to 200 acres. As in the case of construction noise levels, all operational noise levels are referenced at 50 feet from the center of each activity. This produces continuity for subsequent calculations and enables representative comparison of different operational activities. Noise from mining operations can potentially cover a large land area as it moves with the mining activity. Therefore, during the life of the mine, everything within the mine's boundaries would be potentially affected by temporary increases in noise levels. Sound level contributions from each operational activity are summarized and presented in Table 6-21.

Mining activities (including the removal of overburden as well as lignite loading, handling and hauling would occur over an area of many miles. Thus, a single L_{eq} would not accurately represent the sound heard by nearby receptors. The affected receptors would hear different sounds, depending upon their locations.

The greatest potential adverse noise impacts would generally occur during the removal of overburden and mining of lignite. Sound levels have been estimated for the period when mining of lignite occurs simultaneously with the removal of overburden. Both mining of lignite and overburden removal would be conducted on a schedule of seven days per week and three shifts per day. The sound level contribution for both operations is considered to occur throughout the nighttime period. The estimated operational ambient day-night sound level (L_{dn}) at each baseline receptor for operations near the center of the pit and near the edge of the pit are shown in Table 6-22. The table includes the receptor's background ambient sound levels and represents the "worst-case" sound levels during operational activities. Sound level contributions from the above activities were extrapolated from their respective centers of activity to the baseline locations using hemispherical sound radiation analysis techniques. The assumption of hemispherical radiation does not include attenuation due to foliage and ground absorption and is, therefore, conservative. Receptor locations 4, 5, 6, 9, 10 and 12 (Fig. 6-16) are on-site, existing noise receptors, which would be removed after the startup of operations; therefore, these receptors would not be within probable noise impact zones.

The impact evaluation presented here is based on EPA guidelines and strategies. State and local regulations limiting maximum sound levels from mining operations have not been adopted at this time. Most community noise L_{dn} levels presently exceed 55 dBA (EPA, 1978). EPA, in a 1977 strategy document, developed guidelines for a short-term goal L_{dn} of 65 dBA for noise levels outside of structures, such as buildings, residences, etc. (EPA, 1977). The proposed project's worst-case, day-night sound levels would not exceed EPA's short-term L_{dn} guideline of 65 dBA at receptor locations 1, 2, 7, 8, 11, 13, 14, 15, 16 and 17 (Table 6-22; Fig. 6-16). The previously mentioned on-site locations would not include resident noise-sensitive receptors. Examination of Table 6-22 indicates that residents in the vicinity of Receptor Location 3 may be annoyed by outdoor sound levels created by mine operations occurring near the edge of the nearest pit. As pointed out earlier, since the operations are spread out this worst-case noise level probably would not be reached. If the noise level was annoying, mitigation measures, such as berms, could be used to reduce the noise to acceptable levels. Allowing a 24 dBA sound attenuation for exterior wall construction with windows closed (EPA, 1978), sound levels within the interior of residences in this area should be approximately 54 dBA, which is 9 dBA above EPA's interior day-night guideline of 45 dBA. Table 6-22 also presents typical sound levels occurring at nearby noise-sensitive receptors for operations near the center of the nearest pit. Day-night sound levels (L_{dn}) would be below 65 dBA for all off-site receptor locations, thus resulting in minimal impacts.

In summary, the results of Table 6-22 show that receptors immediately adjacent to the mine boundary would experience the greatest potential noise impacts with worst-case L_{dn} sound levels from nearby operations ranging from 58 dB to 78 dB. This reflects an increase in L_{dn} of up to 21 dB during mining operations immediately adjacent to the community of Oak Hill. Even though the increased L_{dn} levels could cause significant

TABLE 6-22

ESTIMATED MINING OPERATIONAL L_{dn}'s AT BASELINE RECEPTOR LOCATIONS

Location	Background Ambient Sound Level (dBA)	Operations Occurring Near the Center of the Nearest Pit		Operations Occurring Near the Edge of the Nearest Pit	
		Composite (Background plus Operational) (dBA)	Increase in Background Noise (dBA)	Composite (Background plus Operational) (dBA)	Increase in Background Noise (dBA)
1	58	58	0	59	1
2	59	60	1	61	3
3	57	61	4	78	21
4	56	-	-	-	-
5	59	-	-	-	-
6	59	-	-	-	-
7	56	-	-	-	-
8	59	59	0	59	0
9	60	-	-	-	-
10	56	-	-	-	-
11	59	59	0	59	0
12	59	-	-	-	-
13	56	57	1	59	3
14	56	60	4	61	5
15	56	57	1	58	2
16	59	59	0	60	1
17	56	57	1	57	1

annoyance to local noise-sensitive receptors at this location, the impact would be short term. Operational noise levels would not exceed background levels in the surrounding population centers of Henderson and Tatum. Nor do operational levels exceed background levels near roadways and railroads. Therefore, mining noise levels would not significantly impact these areas.

Studies undertaken to review the case histories of community response to intruding noise indicate the following (EPA, 1974):

Sound Level Increase	Expected Community Response
0 to 5 dB	No observed reaction
5 to 10 dB	Sporadic complaints
10 to 15 dB	Widespread complaints
15 to 25 dB	Threats of community action
More than 25 dB	Vigorous community action

6.11 LAND USE AND RECREATION

6.11.1 Existing Environment

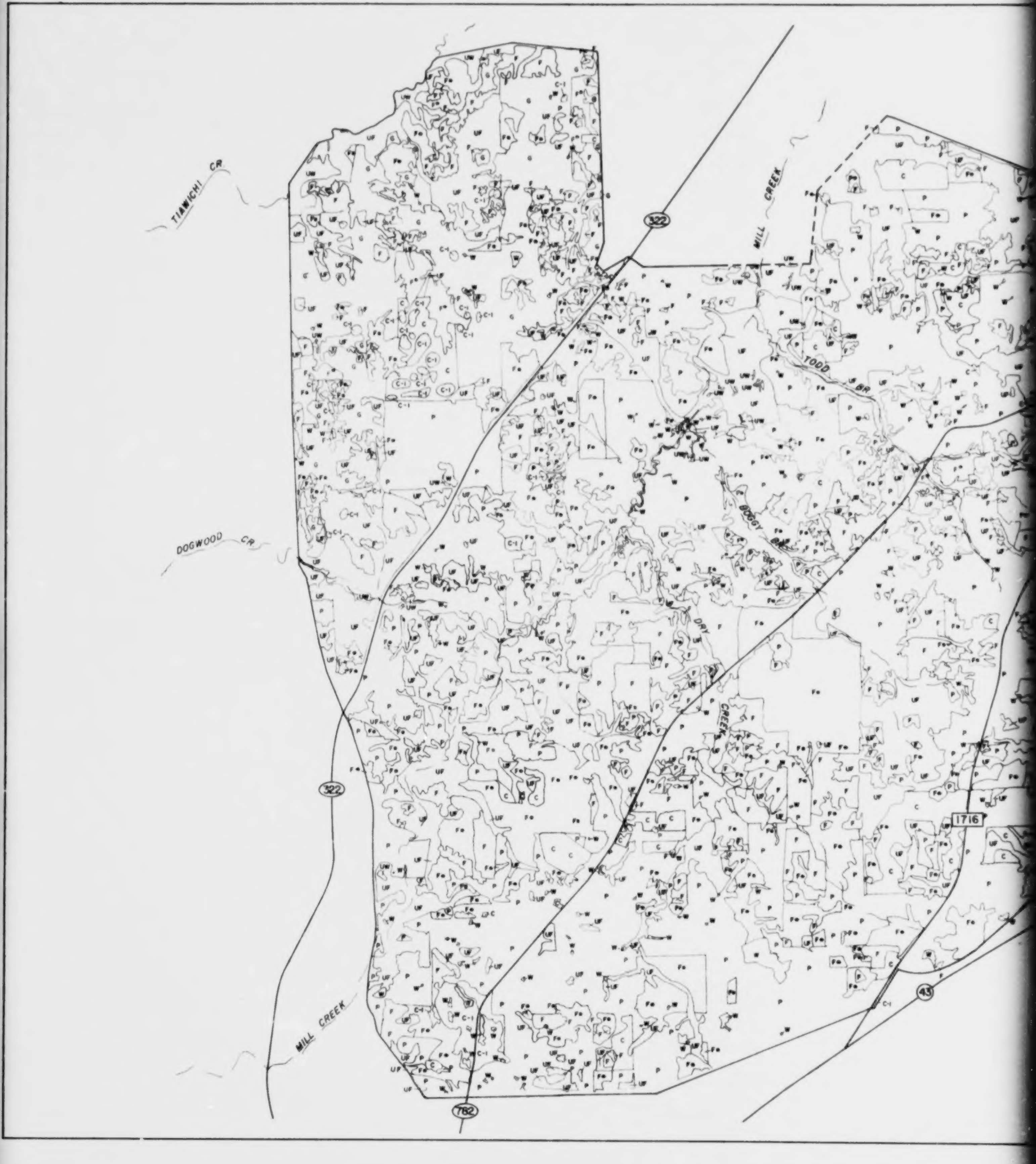
6.11.1.1 Land Use.

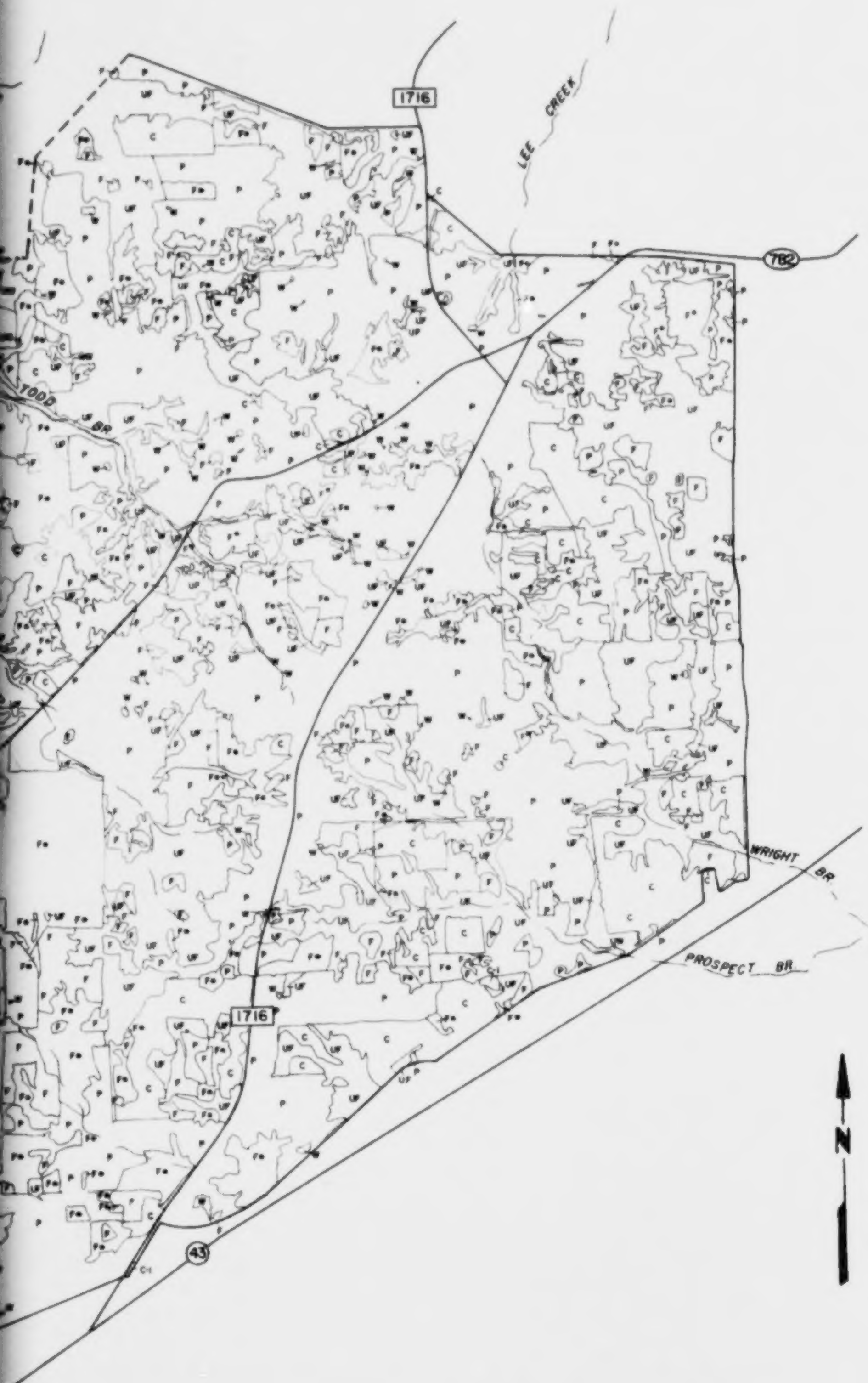
Methodology for Land Use Classification and Mapping. Existing land use patterns on the approximately 24,963-acre project area were determined by photo interpretation of a February, 1980 aerial photograph and verified by ground-truthing. The aerial photographic interpretation was performed on a 1" = 1000' scale photomylar overlay. The delineation of land uses by photo interpreters considered the presence of vegetative cover and indentifiable textural and linear images. For example, croplands are indicated by the presence of row patterns, terraces and grid patterns. Commercial forest lands are indicated by the row patterns, the presence of access (haul) roads, or the presence of homogeneous species. Photo interpretation methods employed to determine land use followed the current guidelines and techniques for photo interpretation of land use/land-cover from remote sensor data (for additional information on methodology see, for example, USGS, 1976). Following photo interpretation, a field survey was conducted to ground-proof map delineations of land uses, which enhances the accuracy through the verification of areas with complex or ambiguous photo imagery. The accuracy level obtained by the professional interpretation methods used is approximately 85 percent

(USGS, 1976). Greater accuracy, allowing precise land use determination for each parcel of land (e.g., classification of changing uses or specialized or multiple uses on a single land parcel), is only possible through extensive land surveys and by interviews with individual landowners. Therefore, the actual designation for any particular parcel may sometimes vary from that determined by using standard methodology. For the purposes of planning and management, including assessment of environmental impacts on a large area, the identification of dominant land use classifications by standard methodology is recommended by USGS (1976).

For the Martin Lake "D" Area project site, land uses (shown in Table 6-23) are categorized in accordance with the U. S. Office of Surface Mining (OSM) pursuant to the Surface Mining Control and Reclamation Act of 1977, 30 U.S.C. 1201 (1977). These categories were adopted by the RRC, Surface Mining and Reclamation Division. The term "land use" is defined under RRC regulations as referring to "specific uses or management-related activities, rather than the vegetation or cover of the land" (RRC, 1980). The Glossary (Chapter 10.0) gives definitions for land use categories pursuant to RRC regulations. No known areas of managed fish and wildlife habitat or recreation were identified on the project site and these classifications were not included in Table 6-23. These categories allow conclusions to be drawn concerning use, management and economic value of the land. USGS categories are defined as a land use and land cover classification system (see USGS, 1976). Consequently, to avoid duplication between vegetation and land use map delineations, the RRC categories are utilized. Due to the differing purposes for vegetation and land use mapping, total acreages for similar categories given for land use (Fig. 6-17, Table 6-23) and for vegetation (Fig. 6-15, Table 6-16) are not comparable. For example, pastureland is a grassland vegetation category that includes hay, but hay that is regularly cut is classified as cropland for land use delineation. Similarly, forest lands are distributed by community type in the vegetation map, but forest areas are considered in terms of production potential for wood and wood products in land use designations.

To provide additional detail and clarification, the categories in Table 6-23, as shown, provide subclassifications for the forestry and undeveloped categories. The subcategories were developed to distinguish between stands of timber of varying levels of management. Mature forest is intensively managed for the production of timber and frequently appears as stands of pine in a row pattern on aerial photography. Transitional forest areas have been harvested and replanted but do not currently contain marketable timber. Undevel-


TIAWICHI CR
MILL CREEK
322
TODD BR
BOGGY BR
DOGWOOD CR
DRY CREEK
322
1716
43
MILL CREEK
782
UF
UW
P
Fo
F
G
C
C-1
W



LEGEND

MAP UNIT	MAP UNIT NAME
C	Cropland
P	Pastureland
F	Forestry
F•	Transitional Forest
W	Developed Water Resources
UW	Undeveloped Water Resources
UF	Undeveloped Forestland
C-I	Commercial-Industrial
G	Grazingland

0 4000
FEET

DATE OF PHOTOGRAPHY : FEB 1983

TEXAS UTILITIES GENERATING CO.
MARTIN LAKE "D" AREA

Fig.6-17

LAND USE

TABLE 6-23
EXISTING LAND USE
MARTIN LAKE "D" MINING AREA

Category[1]	Total Project Site		Within Mine Blocks[2]	
	Acres	Percent	Acres	Percent
Pasture (P)	10,396	41.6	7,915	44.2
Forestry				
Mature (F)	1,949	7.8	1,452	8.1
Transitional (F*)	3,749	15.0	2,804	15.7
Grazingland (G)	1,589	6.4	1,211	6.8
Cropland (C)	1,336	5.4	979	5.5
Undeveloped				
Water (UW)	257	1.0	188	1.0
Forest (UF)	5,327	21.3	3,186	17.8
Water (W)	200	0.8	130	0.7
Commercial-Industrial (C-I)	160	0.6	51	0.3
TOTAL	24,963		17,916	

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[1] The categories listed here are based upon different criteria than vegetation categories (Table 6-16). Thus, acreages for categories with similar names are not the same in both tables.

[2] See Fig. 1-2 for location of generalized mine blocks.

oped forest is not actively managed, and planting and harvesting patterns are not evident on aerial photography.

Project Site Land Use. The majority of land uses in the project area support livestock production. With the exception of small areas of watermelons and corn, the 1,366 acres of cropland identified on the project site are used for the production of sorghum or hay for livestock. The cropland distribution on the site is similar to crop production patterns in Rusk County, where acreage harvested for food crops totaled 1,240 acres compared to 23,400 acres of hay production. Likewise, in 1980, Rusk County farms reported approximately $3.7 million in cash receipts from crop farm marketings compared to about $21.9 million from livestock and livestock products (Texas Department of Agriculture (TDA), 1982).

Based upon Rusk County statistics, the yield acre for hay production is approximately 2.2 tons per harvested acre (TDA, 1982). In 1978, corn grown for grain or seed averaged 8.3 bushels per acre harvested (U. S. Dept. of Commerce, 1981). In Rusk County, in 1978, there was an average of four cows and calves per acre used for grazing, including forage woodlands and pasturelands (U. S. Dept. of Commerce, 1981). Assuming all of the undeveloped forest, pasture and grazingland identified on the Martin Lake "D" site (Table 6-23) is used for grazing, then based upon 1978 stock inventories the site would contain 4,328 cows and calves (about 7 percent of the total 1981 Rusk County inventory). This is a high figure since it is unlikely that 100 percent of this area is used for grazing. The 24,963 acres within the project area constitute about 4.5 percent of the County's total agriculture and woodlands area (ETCOG, 1977). Potential productivity for the project site's pastureland ranges between 8 to 10 animal unit months (AUM), based upon the soil types existant on the site and using SCS soil productivity figures for Panola County. (An AUM is the number of 1,000 pound units of livestock that can graze on 1 acre for a period of 30 days without permanently damaging the pasture.) Based upon this figure, the pastureland on the project site could potentially support about 83,168 to 103,960 AUMs. The total cattle inventory for Rusk County was 61,000 cattle in 1981 (TDA, 1982). The Panola County Soil Survey (USDA, 1975) was used for comparative purposes regarding potential productivity since it is similar in soil types, approximates the Rusk County cattle inventory (58,000) as well as the number of acres in agriculture and woodlands (504,422) (TDA, 1982; ETCOG, 1977).

As indicated in Table 6-23, total cropland constitutes 5.4 percent of the proposed project site, while 41.6 percent is in pastureland. Total agricultural land use within the project site, approximately 12,000 acres, or 47.0 percent of the site, is slightly lower than the 48 percent of land in farms in 1976 for a 14-county region (ETCOG, 1977), which includes Rusk County.

Approximately 15.0 percent of the project area is transitional forest. About 7.8 percent of the project site is classified as mature forestry and these 1,949 acres are intensively managed for the production of timber. Forested land use on the project site, including all three levels of management, comprises 44.2 percent of the project site, of which 7.8 percent is intensively managed.

Within Rusk County, timber production comprises a significant economic resource. Commercial forest acreage included about 291,400 acres in 1975, with the forest industry owning about 6.4 percent, farmers owning about 4.3 percent, and 89.2 percent owned by miscellaneous private owners (Earles, 1976). In 1975, loblolly and shortleaf pine, the most prevalent commercial timber species on the project site, averaged about 682 cubic feet of growing stock volume per acre on commercial forest land in Rusk County (Earles, 1976). In 1979, there were five saw mills in Rusk County producing about 50,469 board feet of pine and 2,053 ties.

The remaining 2.5 percent of the project site is comprised of undeveloped water cover (1.0 percent), developed water resources (0.8 percent) and commercial/industrial (0.6 percent). Developed water resources consist of farm ponds used primarily for stock watering, and industrial acreage is primarily used for oil and gas production.

The railroad and transmission line rights-of-way comprise approximately 400 acres. About 201 acres are undeveloped or transitional forest while about 195 acres are pasture, grazingland or cropland. Undeveloped water accounts for the remaining 4 acres.

6.11.1.2 Recreation. There are no public parks or recreational areas designated by a public agency within the project area. However, the vegetation is supportive of numerous game animals, including deer, bobwhite, mourning dove, fox and gray squirrels and rabbits. (See Sec. 6.6.1 for additional wildlife information.) Additionally, although project area streams are not supportive of game fishes, farm ponds may be stocked with largemouth bass or catfish (see Sec. 6.7.2 for additional information of aquatic species). Based upon

Rusk County data, the project area may support about 8.2 deer per 1,000 acres (TPWD, 1981a).

No specific information is available concerning the extent of private areas leased for hunting. Within the ETCOG 14-county region, approximately 7.9 percent of the total agriculture/woodland acreage consists of private leased hunting lands. This figure is based upon the 1980 Texas Outdoor Recreation Plan (TORP) estimate for the number of acres of leased hunting lands in the 14-county TORP Region 6 (TPWD, 1980) which is identical to the ETCOG region. The figure for agricultural woodland is ETCOG's estimate for 1976, of the region's acreage in woodlands, the primary habitat for game animals (ETCOG, 1977). Applying the ETCOG percentage (7.9) to the project area, about 1,100 acres could be leased as private hunting areas.

6.11.2 Impacts of No Action Alternative

6.11.2.1 Land Use. Long-term trends in land use in the Martin Lake "D" project area are expected to follow regional patterns. In the ETCOG region, agriculture seems to be slowly declining as a land use. There has been an overall decline in farm acreage from 1920 through 1970 (ETCOG, 1977). Recent trends (1969-1978) in land use on farm lands in Rusk County also show declines in the total agricultural land, but an increase in the proportion of forest areas or woodlands used for pasture or grazing (U. S. Dept. of Commerce, 1981, 1977). According to the 1978 Census of Agriculture, farms are defined as any place from which $100 or more of agriculture products were or would normally be sold. Based upon these figures, between 1969 and 1978 the total land in farms in Rusk County declined by 22.4 percent. Cropland decreased by about 7.3 percent, with the proportion of total cropland used for pasture (i.e., grazed) remaining relatively stable over the nine-year period (78 percent in 1969 vs. 75 percent in 1978). Acreage in woodlands (all forested areas) decreased by about 24.7 percent with the percentage of total woodlands used for grazing increasing from 47.5 percent in 1969 to nearly 72.2 percent in 1978. Land in pasture or rangeland (non-cropland and non-woodland) also decreased, by 22.3 percent. Farmlands in other uses (i.e., houselots, ponds, roads, wastelands, etc.) increased by about 8.6 percent, the only increased use category for the nine-year period in Rusk County. The change in farm definition may have resulted in a small over-estimate of overall change. Since the 1969 figures for woodlands used for grazing, pasture or rangeland as well as for other uses are based only on farms with sales of $2,500+, those figures for these categories also may have resulted in the same level of underestimate for declines. (Note that 1974 data were not used due to an undercounting of 12.6 percent of all farms and 22.3 percent of farms with sales less than $2,500 in sales in Texas.)

These trends are consistent with information for Rusk County. According to ETCOG (1977), corridor urban growth is taking place along transportation routes near Henderson and other urban places in Rusk County, increasing the spread of commercial, residential and industrial uses into formerly agricultural areas. There has been a net increase in housing units outside of towns that exceeds the rate of housing growth in towns and cities (U. S. Dept. of Commerce, 1981b). Statistics on the area's commercial forestry also indicate that between 1965 and 1975 commercial forest acreage (on all lands) in Rusk County declined by 4 percent or by about 7,285 acres despite increases in bottomland forest acreage (see Sec. 6.6.3.1). However, in 1975, commercial forestland comprised about 48 percent of the total Rusk County acreage, significantly more than on the project site (Earles, 1976).

Based upon trends regionally and in Rusk County, under the no action alternative, agricultural and total forest acreage would continue to decline and increasingly, woodlands and croplands would be used for grazing.

6.11.2.2 Recreation. Hunting and fishing in the project site area would continue under the no action alternative. Declines in total forested acreage (Sec. 6.6.3.1) may reduce the amount of habitat for game animals.

6.11.3 Impacts of Project Alternatives

6.11.3.1 Land Use. Table 6-23 indicates the acreage by land use included within mine blocks. This acreage includes mine pits, ancillary activities and some areas excluded from mining. Of the 24,963 acres included within the total project area, mining would directly affect only about 15,000 acres, based upon an average of about 500 acres per year over the approximate 30-year life of the mine. The use of the approximately 15,000+ acres would cause significant, short-term land use changes from existing uses to commercial-industrial use. These short-term changes would occur over approximately 30 years. For any single acre, the change would exist over a 7- to 10-year period, during which some joint use could occur (e.g., commercial-industrial and pasture). TUGCO proposes no permanent land use changes. But, especially with undeveloped land, the potential exists that a land use change may be requested. Based upon experience at other mine sites, TUGCO has found that changes from existing use to pasture may be preferred by the land owner. It should be noted that RRC regulations allow for the approval of a drastic change in vegetation while maintaining the existing land use. This could result in long-term, adverse impacts to wildlife but beneficial increases in productivity and economic returns to landowners. Mine facilities and other structures, the railroad spur and the transmission line would cause significant, long-term, reversible impacts to existing land use. TUGCO proposes to restore these facilities to their premining land uses after about 30 years. Until then, their existence would represent an adverse impact on wildlife and agricultural productivity but a beneficial socioeconomic impact (see Secs. 6.13.3 and 6.17.3). Mine areas and roads would be returned to premining uses over a shorter time period than mine facilities, the railroad or transmission line. Certain roads may remain as part of the approved post-mining land use if agreements (which would include terms for maintenance) with the county and the RRC can be made.

Specific land uses that would be affected by mining and auxiliary activities are shown in Table 6-23. About 44 percent, or as much as 7,915 acres, of pasture may be affected. Based upon a potential 8 to 10 AUMs figure per acre, this land could support between 63,320 and 79,915 AUMs under high management (SCS, 1975). Based upon first quarter 1982 prices for choice steers, this represents a maximum value of $5.2 million. About 42 percent, or as much as 7,442 acres, of forested land (all three types) may be affected. This represents good to high quality wildlife habitat to which no dollar value can be easily assigned. There would be a long-term, significant, adverse impact upon forestry. The actual net losses to the forest industry would depend upon the specific schedule of mature and transitional forest land clearing compared to the level of maturity of the forest areas affected. The loss would not be total since any timber removed would be marketed. The major loss would be related to the time required for reforestation. The growth of pine for lumber requires about 30 years, about 23 years for chipping wood and about 16 years for pulpwood (Skove, 1982). Grazingland occupies as much as 1,211 ac or 6.8 percent of the affected area. Loss of cattle production would be a short-term adverse impact (7 to 10 years) after which land uses would be reestablished.

Undeveloped water areas currently have no calculable economic or recreational value. Undeveloped forest may be reestablished or converted to a higher economic yield with short-term adverse impacts on cattle production but a long-term beneficial economic impacts if the land is converted to pasture. Water areas currently used for stock watering or other agricultural purposes would be adversely affected (lost) over the short term, but some ponds would be retained or created, consistent with the approved post-mining land use.

6.11.3.2 Recreation. Because TUGCO does not allow hunting or fishing on areas it controls, there would be a adverse impact to recreation on as much as 1,100 acres during about 30 years (but not on all 1,100 acres in any one year). With increasing population and recreational demand and with less land in wildlife or agricultural use, these impacts would become more significant over time.

6.12 POPULATION

6.12.1 Existing Environment

6.12.1.1 Project-Area Population and Migration Trends. Between 1950 and 1970, Rusk County population declined by more than 20 percent from 42,348 to 34,102 as a result of out-migration among rural residents in the prime age group, 20 to 49 years (USDA, 1975). However, the population in urbanized Gregg County expanded by 24.0 percent to 75,929. Total growth for a 14-county planning region defined by the ETCOG during this period was 2.3 percent.

By 1970, the Rusk County population reversed its declining trend and grew by 21.3 percent to reach 41,382 in 1980. The Gregg County population continued steady growth to 99,487 in 1980, an increase of 31.0 percent. All sizes of communities contributed to population growth during this period up to 1980. The small community of Tatum increased by 90.7 percent to 1,064. Henderson increased by 12.6 percent to 11,473 and Kilgore by 15.5 percent to 2,543 persons in 1980. The Longview metropolitan area increased by 34.1 percent to 61,085.

6.12.1.2 Population Characteristics. As of 1970, the largest portion of the population in each county of the study area was the group below 20 years of age. Between 34 and 38 percent of the county populations were in this age category. In Rusk County, a good deal of out-migration of prime age persons (20-49) has occurred, causing the next two largest age groups in this area to fall between the ages of 50-64 years and 65 and over. In Gregg County, the next two largest age groups were between the ages of 20-34 and 35-49.

6.12.2 Impacts of No Action Alternative

Population projections for the No Action alternative, taking into account 1980 Census data and 1960-1970 and 1970-1980 economic trends, indicate that Rusk County population would expand by 22.4 percent between 1985 and 2000. The Gregg County population is projected to grow by nearly 30 percent during the same period (EH&A, 1981c; ETCOG, 1977; TDWR, 1980).

6.12.3 Impacts of Project Alternatives

The population of Rusk and Gregg counties (primarily) would increase due to the in-migration of 522 new residents during project construction including both primary (hired for the project) and secondary (filling jobs created because of the project) workers and their families (306 primary and 216 secondary) (Table 6-24). These estimates (which include both the workers and their families) are based upon energy employee family characteristics developed by Denver Research Institute (1979) indicating that approximately 60 percent of energy-related construction workers are married with an average family size of 3.55 persons. During long-term mine operation, the peak in-migrating population is estimated at 343 persons (80 primary population and 263 secondary population) (Table 6-24). These estimates are based upon Denver Research Institute employee profiles which indicate that approximately 90 percent of energy-related operations workers are married with an average family size of 3.59 persons. The proposed project would result in a total population influx of 865 persons during both construction and operation, representing a 0.6 percent increase over the current population in the two-county area.

A general indication of the potential distribution of the in-migrating population among the various project area communities (i.e., Henderson, Longview, Kilgore and Tatum) is based upon a location ratio (DRI, 1979; EH&A, 1981c) for each community as determined by current population, population growth rates, and distance from the project site. These variables were chosen based on the assumption that an in-migrant's desire to live in a particular community is directly related to the community's distance from work and its relative amenities. Population and population growth rates were used as variables to estimate amenity levels. As population increases, it can generally be assumed that an area offers a greater level of amenities (i.e., education and recreation opportunities, retail variety) and therefore, is an attractive place to live. According to this

TABLE 6-24

ESTIMATED PRIMARY AND SECONDARY POPULATION IN-MIGRATION DURING PROJECT CONSTRUCTION AND OPERATION[1]

Month/Year	Project Construction		Project Operation		Total
	Primary	Secondary	Primary	Secondary	
1/1983-6/1983	122	82			204
7/1983-12/1983	306	216			522
1/1984-6/1984	296	206			502
7/1984-12/1984	182	127	10	0	319
1/1985-6/1985	91	63	33	0	187
7/1985-12/1985	91	63	50	83	287
1/1986-6/1986			54	103	157
7/1986-12/1986			54	103	157
1/1987-6/1987			63	163	226
7/1987-12/1987			73	223	296
1988-1990			73	223	296
1991 through project life			80	263	343

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[1] Based upon the primary and secondary in-migrating work forces and worker profile information compiled by Denver Research Institute (1979) and Mountain West Research, Inc. (1975). The figures include both workers and their families.

methodology, Henderson could potentially capture 19 percent (99 persons) of the in-migrating construction population, while Longview could capture 60 percent (313 persons), Kilgore 6 percent (31 persons), Tatum 1 percent (5 persons), and 14 percent (73 persons) would be distributed among other communities in adjacent counties.

During the long-term operation of the mine, it is anticipated that workers would choose to live closer to the project site (i.e., Henderson) than the construction workers who are assumed to prefer a larger city (DRI, 1979) and are willing to commute further to work for the temporary period. This conclusion is also born out by TUGCO's current employee residence information which indicates that the largest percentage of workers live in Henderson which is within 10 miles of the project site (Appendix L). It is estimated that Henderson could conceivably receive 50 percent (172 persons) of the in-migrating operation population, while Longview would receive 20 percent (69 persons), and Kilgore and Tatum each receiving 10 percent (34 persons), with the remaining 10 percent (34 persons) distributed in rural portions of the project area or communities in adjacent counties.

6.13 ECONOMY

6.13.1 Existing Environment

6.13.1.1 Labor Force and Employment. In Rusk County, both employment and civilian labor force grew at a rate of 5.2 percent per year between 1974 and 1980. However, since 1978 the labor force has grown at an annual rate of 8.3 percent, while employment opportunities expanded by only 7.9 percent. In 1980, Rusk County had an estimated labor force of 20,830 with 19,858 employed (TEC, 1980). The resultant unemployment drove the unemployment rate from 3.9 (918) to 4.7 percent in 1980. Labor force growth in Gregg County outstripped employment opportunities by 0.4 resulting in an unemployment rate in excess of 6.5 percent in 1980 with a labor force of 44,276 and employment of 41,404 (TEC, 1980).

6.13.1.2 Employment by Industry. The major source of employment (U.S.D.O.C, 1981) in Rusk County is the service sector, which generated 19.6 percent of all local jobs in 1979. Manufacturing, retail trade and government together contributed nearly 40 percent of county employment. Since 1977, several sectors in this county have demonstrated declining employment, most notably in construction and manufacturing of nondurable goods.

Gregg County, which historically has had an oil-dependent economy, currently derives 20.9 percent of its total wage and salary employment from manufacturing. Retail trade and services constitute 18.9 and 18.2 percent, respectively, of local employment. Construction employment in Gregg County has demonstrated the greatest growth since 1977, expanding at an annual rate of 13.7 percent and constituting 8.3 percent of employment in the county.

Employment in areas surrounding the two-county project area within convenient commuting distance (i.e., 35 miles) of the proposed project site, is similarly concentrated in manufacturing, services and trade. Mining employment, however, demonstrated one of the fastest growth rates in the area, particularly in Harrison County where it increased at an annual rate of 33 percent since 1974.

6.13.1.3 Personal Income. Approximately 50 percent of total personal income in Rusk County was derived from private industry. Major sources of personal income in the county in 1979 were mining and construction (U.S.D.O.C., 1981). Private industry accounted for approximately 75 percent of total personal income in Gregg County in 1979. Manufacturing, trade and services tended to parallel trends for the State of Texas by providing the greatest income sources in Gregg County.

The fastest growing source of income in the state between 1972 and 1979 was mining (U.S.D.O.C., 1981). The greatest growth in personal income derived from mining occurred in adjacent Harrison County, which expanded at an annual rate of 45.5 percent during the 1972-1979 period, followed by a 33.6 percent annual increase in neighboring Panola County to the south and a 25.9 percent increase in Gregg County.

6.13.1.4 Leading Economic Sectors. Principal manufactured products include mining and oil-related equipment and machinery, fabricated metal products, and timber products and logging-related equipment. Twenty-eight manufacturing firms employ 100 persons or more, while 12 of these employ more than 250 persons (the largest employs more than 1,000 persons) (UT, 1981). A total of 11,565 persons are employed in the manufacturing sector in Rusk and Gregg counties.

Several large manufacturing plants are located near the mine site in the cities of Henderson and Kilgore, four of which employ at least 250 persons. The Longview area is an industrial supply center for the area. Thirty-nine manufacturing plants are located there, and nearly 60 percent of their markets are national or international (UT, 1981).

Henderson is an expanding retail market, with sales increasing by 11.9 percent between 1972 and 1979 (U.S.D.O.C, 1982a). Henderson also experienced rapid growth of wholesale trade sales (U.S.D.O.C, 1982b) area, with sales increasing by 16.3 percent. Retail sales in Longview experienced rapid growth with sales increasing by 14.5 percent.

Historically, oil and gas production has been the foundation of the economy in Rusk and Gregg counties (RRC, 1979). More recently, oil and gas production has declined in the area, and lignite production has emerged as a major economic component.

6.13.2 Impacts of No Action Alternative

Various manufacturing and potential mining activities in the area enhance the likelihood of expanded employment opportunities in the near future (ETCOG, 1982). Occupational skills in the area indicate that the labor force is sufficiently skilled to meet a reasonable share of expanding employment needs.

6.13.3 Impacts of Project Alternatives

Direct economic impact of project construction would include both the creation of jobs and the resultant generation of increased income. The project construction work force would be comprised of local residents (within 35 miles of the proposed project site) and in-migrants. As shown in Table 6-25, it is anticipated that local workers would provide approximately 40 percent (81 positions) of the needed peak construction work force of 202 in late 1983, while in-migrants would fill the remaining 121 positions. This distribution is based upon the use of local labor for land clearing, initial grading, building construction and dragline erection; and in-migrant contract labor for major rail and transmission line construction.

Project construction employment is expected to support secondary employment arising from economic gains in trades and service industries, which either supply the project with materials and equipment or are affected by the spending of project personnel.

The transient nature of the construction work force means that only a portion of worker income would be spent in the local area, thereby reducing the overall secondary employment effects. As shown in Table 6-26, a maximum of 162 secondary jobs are expected to be supported by project construction. These include existing jobs in such

TABLE 6-25

ESTIMATED PROJECT (PRIMARY) WORK FORCE

Month/Year	Project Construction Primary	Project Construction In-migrant	Project Operation Primary	Project Operation In-migrant	Total
1/1983-6/1983	32	48			80
7/1983-12/1983	81	121			202
1/1984-6/1984	78	117			195
7/1984-12/1984	48	72	27	3	150
1/1985-6/1985	24	36	90	10	160
7/1985-12/1985	24	36	135	15	210
1/1986-6/1986			144	16	160
7/1986-12/1986			144	16	160
1/1987-6/1987			171	19	190
7/1987-12/1987			198	22	220
1988-1990			198	22	220
1991 through project life			216	24	240

TABLE 6-26

ESTIMATED SECONDARY WORK FORCE[1]

Month/Year	Project Construction		Project Operation		Total[3]
	Resident	In-migrant	Resident[2]	In-migrant	
1/1983-6/1983	39	25			64
7/1983-12/1983	97	65			162
1/1984-6/1984	94	62			156
7/1984-12/1984	58	38	45	0	141
1/1985-6/1985	29	19	150	0	198
7/1985-12/1985	29	19	200	25	273
1/1986-6/1986			209	31	240
7/1986-12/1986			209	31	240
1/1987-6/1987			236	49	285
7/1987-12/1987			263	67	330
1988-1990			263	67	330
1991 through project life			281	79	360

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[1] Estimated secondary work force is the work force required to fill jobs created because of the project but not directly working on the project.

[2] Resident employment includes the peak 162 construction-induced secondary jobs (which can now be supported by O&M activities) plus 60 percent share of operations-induced secondary jobs.

[3] Total construction-induced secondary employment = 0.8 x total primary construction employment. Total operations-induced secondary employment = 1.5 x total primary operations employment.

areas as sales, clerical, craftsman and non-farm laborers which might otherwise be eliminated without the impetus of a large energy project, as well as new jobs (of the same type) created due to increased business investment. There is usually a lag period of two to three years before local secondary services expand in response to new employment at a large project.

Direct, short-term, beneficial income impacts include wages and salaries paid to construction workers, and land and capital expenditures to landowners and business. Secondary, short-term, beneficial income impacts to businesses arise from expenditures by construction workers and from expanded income generated by land and capital acquisition transactions.

As shown in Table 6-27, an estimated $29 million (1981 dollars) in total direct labor expenditures is projected over the three-year construction period. Local secondary income to the area resulting from construction worker consumer expenditure is estimated at $62 million over the three-year period, assuming a regional secondary income multiplier of 2.126 (U.S. Dept. of Commerce, Bureau of Economic Analysis, 1979).

The average annual income associated with peak project construction labor (202 workers) is estimated to be approximately $4.4 million, based upon an average salary of $22,000 per year. In 1979, the average annual salary for workers in Rusk County was $10,388 and $11,530 in Gregg County (TEC, 1979).

In addition to direct labor expenditures, $113 million would be expended for land and capital equipment acquisition during the three-year construction period. Approximately 10 to 20 percent ($11 million to $23 million) of the total $113 million is expected to be spent locally, about $4 million to $8 million per year. An additional $14 million to $29 million in local secondary income would be generated during that three-year period. Secondary income is based upon a regional income multiplier of 2.126 and a local expenditure capture rate of 60 percent. The income multiplier provides an indication of how each dollar spent directly on the project generates additional income in secondary/support services (i.e., retail, financial, transportation services). The local capture rate indicates what level of income those workers living in the local area would actually spend in the immediate area as opposed to a "spending leakage" in a distant urban center.

TABLE 6-27

ESTIMATED PROJECT EXPENDITURES[1]

Cost Item	Total Construction Period	Average Operations and Maintenance Year
Labor (including direct wage/ and salary benefits)	$ 29,000,000	$ 8,000,000
Land Purchase/Lease	3,000,000	1,000,000
Capital Expenditures (including machinery, materials, power and fuels)	110,000,000	22,000,000
Other (including insurance, taxes)	1,000,000	14,000,000
Total	$143,000,000	$45,000,000

[1] Estimated expenditures include construction and operation of the railroad and transmission line.

Source: TUSI, 1981.

As shown in Table 6-25, as much as 90 percent (i.e., 216 workers in 1991) of the needed long-term work force is anticipated to consist of local residents. This assumption is based upon the availability of a relatively large local labor pool as evidenced by the fact that TUGCO recently has been receiving 200 job applications per day, the majority of which have come from areas within 35 miles of the proposed project site. In addition, TUGCO operates a worker training center at Athens in nearby Henderson County, enabling the company to effectively train unskilled persons and ultimately support its hiring policy of utilizing local labor as much as possible (TUGCO, 1982).

As shown in Table 6-26, a maximum of 360 secondary jobs could be supported by the long-term operation work force fully on site beginning in 1991. Due to the presence of 162 service jobs generated during peak construction activities, 162 of the new operations-induced service positions could be filled by existing residents. In addition, local residents are expected to account for a 60-percent share of the remaining operations-induced service jobs. Essentially, the direct operations work force supports existing employment which might otherwise be dismissed; the 360 secondary jobs represent about 0.5 percent of the 1980 employment in Rusk and Gregg counties.

Income effects of operations activities of the proposed project would include direct income from wages, salaries and capital expenditures, as well as secondary income arising from increased consumer spending and expanded capital expenditures. Average annual operations and maintenance expenditures (Table 6-27) are estimated at $45.0 million (1981 dollars). Direct wage and salary annual expenditures are estimated at $6.0 million plus $2.0 million in benefits, providing a substantial long-term benefit to local persons.

Local secondary income resulting from operations worker consumer expenditure is estimated at $11.4 million annually, assuming a regional secondary income multiplier of 1.892 (U. S. Dept. of Commerce, Bureau of Economic Analysis, 1979). In addition to these local secondary income effects, a certain percentage of land and capital expenditures would be made within the two counties, thereby inducing further local income effects. In an average operations and maintenance year, $23.0 million would be expended for land acquisition, machinery, materials, power and fuels. Approximately 70 percent, or $16 million, is expected to be spent within the two counties (TUGCO, 1981). Assuming a local expenditure capture rate of 60 percent and an income multiplier of 1.892, an additional $18.0 million in local secondary income would be generated during an average operations and maintenance year, providing local businesses with a more stable income base for the life of the project.

6.14 HOUSING

6.14.1 Existing Environment

Between 1970 and 1980, the number of total housing units in Rusk and Gregg counties area grew by more than one-third (38.6 percent). Over 75 percent of these units were built in Gregg County (increasing to 39,525 units in 1980), with Longview capturing approximately 73 percent of this increase, totaling 25,106 units in 1980. The number of units in Tatum increased by 94.8 percent to 491 units in 1980. Housing in Kilgore increased by 23.8 percent to 4,595 units in 1980, while units in Henderson increased by 20.3 percent to 4,624 in 1980.

The City of Longview has experienced the greatest increase in housing starts during the past 10 years. Single-family housing units ranging between $60,000 and $70,000 are readily available, as are duplexes. Over 400 apartment units were recently completed, although most have already been rented. Sufficient developable land can be found within the city limits, as well as surrounding areas.

However, 1970-1980 housing development in other portions of Rusk and Gregg counties area has not resulted in a large number of available units. Rental property in particular is in short supply in Henderson, Kilgore and Tatum. Estimated 1980 vacancy rates of two and three percent reflect a tight housing situation. Overall, housing problems in the area stem from housing costs. While the demand for housing is recognized, the present high interest rates for construction and the influence of high interest rates on long-term financing will probably moderate construction and keep new single family housing starts below demand and there will be no excess of pre-existing houses for sale.

6.14.2 Impacts of No Action Alternative

Housing availability varies among communities in the project area, although most cities are experiencing shortages. Housing need is expected to increase due to the planned energy projects in the region, apart from the proposed project. Rental property is foreseen as a high priority. However, any construction activity (single-family units or apartments) would be greatly dependent upon interest rates and financing arrangements. Recent declines in interest rates for construction and long-term financing could stimulate construction activity.

6.14.3 Impacts of Project Alternatives

The in-migrating primary population during peak construction activities represents 111 new households while the in-migrating secondary population represents 63 new households for a total of 174 new households. Based upon the potential distribution of the in-migrating population as discussed in Sec. 6.12.3, Longview is expected to receive a demand for 104 housing units (Table 6-28). Based upon surveys of worker housing preference when all types are available (Denver Research Institute, 1979; Mountain West Research, Inc., 1975), the total 174 project-related new households could require 61 single-family units, 29 multi-family units, 70 mobile homes, and 14 other housing types. When sufficient number of these housing types are not available in a given location to supply worker preferences, other locations or other housing types are chosen.

Longview experienced the greatest increase in housing starts over the last 10 years, therefore, single-family and multi-family units are available, although many of the 400 apartment units are already rented. Sufficient developable land within and outside the city limits is available. It should be noted that residential development outside the city limits would be confronted with the need to negotiate arrangements for public services (i.e., water, sewer, fire protection) either with the city, county or private suppliers.

With the shortage of rental property in the other communities in the project area, apartment construction would be needed to accommodate new residents, although the temporary demand during the project construction period is not foreseen as a severe impact.

The in-migrating primary and secondary population over the long-term mine operation represents a total of 101 new households (24 primary and 77 secondary). Based upon the population distribution discussed earlier, Henderson is anticipated to face a demand for 51 new housing units, Longview 20 units and Kilgore and Tatum each 10 units. The remaining 10 units are expected to be accounted for in other portions of the project area (Table 6-27). The total 101 new households could require 29 single-family units, 26 multi-family units, 39 mobile homes and 7 other housing types (Denver Research Institute, 1979).

TABLE 6-28

ESTIMATED DEMAND FOR COMMUNITY FACILITIES AS A RESULT FOR PRIMARY AND SECONDARY PROJECT POPULATION IN-MIGRATION[1]

Community	Housing Units	Water Supply/ Treatment (MGD)	Sewage Treatment (MGD)	Police Personnel	Fire Personnel	Doctors
Longview	(25,106)	(34.0)	(7.77)	(98)	(81)	(99)
Construction	104	0.048	0.052	0	0	0
Operations	20	0.011	0.011	0	0	0
Henderson	(4,624)	(7.85)	(1.33)	(22)	(35)	(17)
Construction	33	0.015	0.016	0	0	0
Operations	51	0.026	0.028	0	0	0
Kilgore	(4,595)	(8.57)	(0.89)	(52)	(31)	(9)
Construction	10	0.005	0.005	0	0	0
Operations	10	0.005	0.006	0	0	0
Tatum	(491)	(0.38)	(0.28)	(2)	(38)	(0)
Construction	2	0.001	0.001	0	0	0
Operations	10	0.005	0.006	0	0	0
Other Areas	(50,737)	(15.9)	(4.41)	(240)	(105)	(44)
Construction	25	0.011	0.012	0	0	0
Operations	10	0.005	0.006	0	0	0

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[1] Existing capacities or units (1980) are enclosed by parentheses.

6.15 COMMUNITY SERVICES

6.15.1 Existing Environment

6.15.1.1 Police Services. A total of 226 full-time law enforcement officers, consisting of 2 sheriffs, 53 deputies, 9 constables, 17 state troopers and 145 municipal police officers, serve the two-county study area. An additional 71 officers are on reserve in the two-county project area. The service ratio of officers to population ranges from 1:457 in Kilgore to 1:1,064 in Tatum as compared to the Texas Commission on Law Enforcement standard of 1:1,000.

6.15.1.2 Fire Protection Services. The terms "key rate" and "5-year Loss Premium Ratio" are used by the Texas Board of Insurance in determining the adequacy of a municipality's fire protection facilities. The lower the key rate, the more adequate is the facility. The key rate in the major project area communities averages 0.20 with the exception of Tatum at 0.95 (which indicates the least adequate facilities in the two counties).

The five-year loss premium ratio is the percentage of insured fire loss to the total of premiums paid for fire insurance within a given city over a five-year period. This ratio indicates the net profitability to the fire insurance carriers for providing fire insurance coverage within the city and, as such, is a direct indicator of fire risk and an indirect indicator of the adequacy of fire protection services. Low loss premium ratios in Henderson and Longview qualify for a 5 to 25 percent credit on premiums. Kilgore has a high loss premium ratio and is penalized by a 5 to 15 percent surcharge on fire insurance premiums (Texas Board of Insurance, 1981).

The Fire Marshall's Office also sets standards for the minimum number of firefighters a municipality should have. Cities with populations of over 7,500 should employ 1.5 firefighters for every 1,000 residents. Henderson, Longview and Kilgore have 1.1, 1.3 and 2.8 paid firefighters, respectively, per 1,000 residents. However, the City of Henderson has 22 additional volunteer firefighters. Small towns (less than 7,500 population) should have a minimum of either five paid firefighters or 20 volunteer firefighters, five of which must be able to operate all equipment. Tatum has an adequate number of firefighters, although no information is available concerning the number of firefighters who can operate all the equipment (Texas Board of Insurance, 1981).

6.15.1.3 Health Services. Four hospitals with a total of 523 beds, 21 clinics and 11 nursing homes with a total of 1,149 beds are located in the two-county project area. Accepted health standards of one doctor for every 1,000 residents and one dentist for every 2,000 residents (Chalmers and Anderson, 1977) have been met by the major communities in the area. The Henderson Memorial Hospital, located in Henderson and closest to the project site, offers complete hospital services, including emergency room, intensive care coronary unit, physical and inhalation therapy, and other services (Henderson Chamber of Commerce, 1981).

Two hospitals, the Good Shepherd and Longview Regional, provide hospital care to residents of Longview and surrounding areas. Other facilities in Longview include the Mental Health and Mental Retardation Center, the Mental Health Association of Gregg County, the Gregg County Association for Retarded Citizens and the Gregg County Home Care Visiting Nursing Service (Longview Chamber of Commerce, 1981). The Roy H. Laird Memorial Hospital the East Texas Treatment Center for the Handicapped, serving 14 counties, are located in Kilgore. Emergency Medical Service (EMS) is available in Henderson, Kilgore and Longview.

6.15.1.4 Public Educational Services. During the 1980-1981 school year, 16,161 students were enrolled in schools in the project area communities. Over two-thirds of the students were Anglo, with the remainder consisting of blacks (30 percent) and hispanics and other (1 percent). The majority of all students was enrolled in elementary school. Student/teacher ratios averaged 13.2:1 to 17.8:1 in the project area in 1981.

Private and parochial schools are available in Longview, and nearly all school districts offer vocational education. The Plumbers Apprentice School and Aladdin Beauty College are both situated in Longview. Longview is the home of Letourneau College, a private four-year Christian college specializing in engineering and highly skilled trades. Kilgore Junior College in Kilgore is also located within the two-county area.

6.15.1.5 Utilities. The four project area cities qualify for the Texas Department of Health's "approved" status, which indicates compliance with the minimum standards of quality and quantity for public water supplies. However, the cities vary considerably in overall current capacity and ability to serve additional connections.

The most constrained municipal water systems in the area are in Henderson and Tatum. Henderson has substantial excess treatment plant capacity (7.85 MGD total), but is deficient in elevated storage (0.76 MG total). Tatum is also deficient in storage capacity (0.097 MG total elevated and ground storage). The Texas Department of Health recommendations include expansion of elevated storage facilities (TDH, 1980). The City of Kilgore, however, has an estimated additional capacity of 4,158 connections.

Based upon the data for sewage treatment facilities presented in Table 6-29, Longview and Kilgore have the best effluent water quality and greatest capacities to accommodate additional sewer connections. Modifications in physical plants or operating procedures for Henderson and Tatum may be necessary in the near future to meet permit requirements (TDWR, 1981). Henderson has applied for a permit from TDWR for a new wastewater treatment plans, with a capacity for over 1,800 additional connections (6,000 persons), to supplement its present facilities.

Southwest Electric Power Company (SWEPCO) provides electricity to most communities in Rusk and Gregg counties. In addition, the Rural Electrification Administration (REA) provides electricity to the City of Tatum and to rural parts of the two counties. Natural gas is supplied by Entex, Inc. and Southern Gas. Phone service is available through General Telephone Company of the Southwest, Southwestern Bell, Tatum Telephone Company, and Eastex Telephone Company. Butane for mobile homes is available from local dealers.

6.15.2 Impacts of No Action Alternative

Under the "no action" alternative, community facilities and services in the project area would expand as necessary to meet population increases. Additional water storage and improved sewage treatment facilities are planned for Henderson and Tatum over the next several years to meet expected growth. Tatum is currently drilling three additional water wells. Police and fire protection are adequate for existing populations while medical and school facilities can accommodate a moderate increase in demand.

6.15.3 Impacts of Project Alternatives

6.15.3.1 Construction Period. The project-related in-migrating population would place additional demands on local utilities, services and housing in the two-county project

TABLE 6-29

MUNICIPAL SEWAGE TREATMENT FACILITIES FOR SELECTED CITIES IN RUSK AND GREGG COUNTIES

City	Permitted Flow (MGD)		Number of Connections	Estimated Excess Flow Capacity (MGS)[1]	Capacity for Additional Connections	1980 Permit Parameter Non-Compliance Record
	Avg Daily Flow	Max Daily Flow				
Kilgore	1.5	3.0	4,100	1.325	5,053	Exceeded parameters for BOD and TSS in 1980
Longview						
01:	0.86	1.73	18,010	2.16	4,045	01: Exceeded parameters for BOD and TSS in 1980
02:	8.50	13.00				02: Excellent quality effluent
Henderson	2.0	4.0	3,961[2]	0	0	Exceeded parameters for BOD and Avg Max Flow for 1980
Tatum	0.1	0.2	570	0	0	Exceeded parameters for BOD, TSS and Flow for 1980

[1] Based on 80 percent Permitted Maximum Daily Flow.

[2] Estimated.

Source: Texas Department of Water Resources, 1981.

area. The 306 primary construction workers and their families in-migrating during the peak construction period would require approximately 0.047 million gallons per day (MGD) of potable water supplies, while the 216 in-migrating secondary population would require 0.033 MGD, assuming average consumption of 155 gallons per capita per day (GPCD). Distribution of the 0.080 MGD peak construction period demand throughout the project area communities is shown in Table 6-28. Minor adverse impacts could result from the need to expand the existing water lines to accommodate additional connections.

The 306 peak in-migrating primary population is estimated to generate a sewage system demand of 0.051 MGD, assuming a requirement of 168 GPCD (Chalmers and Anderson, 1977). Secondary in-migrants would require 0.036 MGD, resulting in a total additional demand of 0.087 MGD in the two-county area. Distribution of the additional sewage system demand among communities is shown in Table 6-28.

Sewage treatment facilities in Henderson and Tatum were deficient in meeting permit parameters in 1980 and additional demand could cause additional service problems. Both cities are planning facility improvements over the next few years (TDWR, 1981; Hatley, 1981; Farley, 1980). If Henderson is granted a permit for its 1.0 MGD plant, no adverse impact would occur as long as the plant is constructed and operational within about two years. Municipal sewage systems in Longview and Kilgore could support the additional population increase with no adverse impact. Solid waste disposal facilities in the two counties are adequate to serve the additional projected demands.

Police and fire protection services would not be adversely affected by the peak 522 in-migrating primary and secondary population. The current ratio of law enforcement personnel to population in the major communities in the two-county project area compares favorably to the recommended standard of 1:1,000, thereby enabling local communities to accommodate additional residents. Similarly, the number of firefighters per 1,000 population is at or just above the recommended standard of 1.5:1,000. The proposed project in-migrating construction population is not sufficient to require additional personnel. Health services facilities in the project area are estimated to be sufficient to handle the additional project-related population. The 522 in-migrants would not cause a need for additional medical personnel.

The addition of 47 school-age children in the two counties during peak construction activities (26 primary population and 21 secondary population) would not cause an adverse impact to local schools (16,161 students). All of the major communities currently exhibit favorable teacher-student ratios (average of 1:16) relative to the recommended standard of one teacher per 19 students. It is estimated that nearly 80 percent of incoming students would be enrolled in Henderson and Longview school districts combined, requiring no additional staffing.

6.15.3.2 Operations Period. Additional water demand generated by the in-migrating primary operations population is expected to total 0.012 MGD assuming average consumption of 155 GPCD. The in-migrating secondary population would require 0.040 MGD of potable water supply. This total water demand of 0.052 MGD is estimated to be distributed at 0.026 MGD in Henderson, 0.011 MGD in Longview, 0.005 MGD each in Kilgore and Tatum, and 0.005 MGD in the surrounding area (Table 6-28).

The in-migrating operations population would generate an additional sewage system demand of 0.057 MGD (0.013 MGD primary and 0.044 MGD secondary), assuming 168 GPCD. Community distribution is shown in Table 6-28.

If water storage and sewage treatment improvements are initiated in Henderson and Tatum during the construction period, no additional adverse impact would be created during project operation. Both Longview and Kilgore can accommodate increased water and sewage system demands during project operations.

The long-term in-migrating population of 343 persons (Table 6-24) would not require any additional law enforcement or firefighting personnel, and is not expected to generate any measurable adverse impact.

Medical facilities are not anticipated to be adversely affected by the in-migrating population. Increased school enrollment associated with the 34 in-migrating school-age children would not require additional staff or classroom space.

6.16 TRANSPORTATION

6.16.1 Existing Environment

The primary east-west thoroughfare for truck and auto transportation through the 14-county ETCOG planning region is Interstate 20, providing the most direct route between

Shreveport and Dallas. U.S. 80 also connects Shreveport and Dallas, while interconnecting Marshall, Hallsville and Longview. The major north-south transportation route is U.S. 259, providing connections between the cities of Daingerfield, Longview, Henderson and Nacogdoches. The most immediate access routes to the project site are SH 322, FM 782, FM 1716 and SH 43.

SH 43 from Marshall to Henderson has been recommended for upgrading. The City of Longview recommends upgrading of U.S. 259 north of Longview to Daingerfield, which would provide better access to U.S. 30 and U.S. 271, and upgrading U.S. 59 from Jefferson to Atlanta (City of Longview, 1979). At present, regional population centers have no mass transportation system. A rural mass transportation study is being conducted (Buchanan, 1981).

Air transportation is available from two regional airports, Gregg County Airport in Longview and Pounds Field in Tyler, to Dallas and to Houston. Charter flights are also available. Gladewater Municipal Airport and Kilgore Community Airport also provide limited services. Regionally, Dallas and Shreveport airports provide passenger jet airline service. Rusk County Airport is located within 10 miles of Henderson and provides chartered service.

Rail freight service is available in the area from the Missouri-Pacific and the Atchison, Topeka and Santa Fe systems. Longview is located on the Missouri-Pacific's main line between St. Louis and El Paso and also is a junction point with the Missouri Pacific's main line south to Houston, San Antonio, Laredo, and the Gulf ports. A total of 36 scheduled freight trains operate through Longview.

Four motor freight lines serve the area. Daily bus service to other cities is available from Longview.

6.16.2 Impacts of No Action Alternative

The "no action" alternative would have no impacts on the local transportation system.

6.16.3 Impacts of Project Alternatives

FM 782, FM 1716 and SH 43 will experience traffic increases as a result of both equipment movement and employee trips. In addition, SH 322 and U.S. 259, which provide access to Longview and Kilgore, are expected to experience greater traffic volumes.

The peak construction employment of 202 workers is projected to generate approximately 337 employee vehicle trips per day, assuming 1.2 persons per vehicle and two trips per day. The average daily traffic (ADT) along FM 782 between Henderson and Tatum would increase by 67 percent from 500 ADT to 837 ADT. SH 43 ADT would increase 8 to 15 percent from its current range of 2,200-4,000 vehicle trips. Peak construction traffic, however, would only occur during a three- to six-month period in mid-1984.

The long-term operations work force of 240 would represent an increase of 400 vehicle trips per day in 1991 with full operation. Trips would be evenly distributed over three shifts per day, seven days per week, thereby minimizing overly-heavy traffic movement at any given time. As during construction activities, FM 782, SH 43, SH 322 and U. S. 259 would experience the greater proportion of increased traffic.

Total trips (both work- and non-work-related) generated by the in-migrating construction population (primary and secondary) are estimated at 1,740, assuming each of the new 174 households would generate approximately 10 vehicle trips per day (Institute of Traffic Engineers, 1979). During long-term operations, the 101 new households are estimated to generate 1,010 trips per day. Most of these increases would occur in the cities where the in-migrating population would be located (i.e., Henderson, Longview, Kilgore and Tatum). The additional traffic load would not generate significant adverse impacts, although minor improvements (i.e., signalization of some urban intersections) could be adviseable to mitigate the minor short-term adverse impacts of increased traffic.

In general, the serviceability of farm-to-market roads could be affected due to increased traffic, particularly construction-related trucks. These roads are not constructed for large volumes or particularly heavy loads. Therefore, an increase in heavy wheel loads would affect the flow of traffic along these routes, as well as contribute to road surface deterioration more quickly than would otherwise occur.

6.17 COMMUNITY FINANCES

6.17.1 Existing Environment

6.17.1.1 County Budget Summaries. Property taxes account for nearly 55 percent of county revenue in the two-county project area. Intergovernmental receipts and "other" sources, such as interest on income, rents, and the sale of Certificates of Obligation, account for 23.6 percent of Rusk County's revenues and 34.2 percent of Gregg County's revenues.

Based on information from the Auditors' offices of Rusk and Gregg counties, approximately one-fourth of county expenditures is spent on general administration, including general and financial administration, judicial, legal and elections. Outlays for public transportation (including road improvements) averaged 30 percent in 1980. Both counties spent money on public safety. Capital outlays captured one-fourth of Gregg County's expenditures, while "other" captured 25.1 percent of expenditures in Rusk County.

6.17.1.2 Municipal Budget Summaries. According to municipal budget reports, property and sales taxes contributed the greatest amount of total municipal revenues during the 1980-1981 fiscal year. Property taxes constituted the greatest percentage of revenues in Henderson, while sales and other taxes ranked first in Kilgore and Longview.

Henderson spent 18.8 percent of its budget for public safety and 26 percent for water. The majority of Kilgore's budget was spent for public safety (44.3 percent) and water utilities (35.4 percent). Longview's expenditures were broken down by operating expenses, capital outlay (public works), and debt requirements. Nearly four-fifths of Longview's proposed 1980-1981 revenues were spent on salaries, supplies, maintenance, contractual services and sundry charges for all city departments. Over $3 million (17 percent) was also allocated for debt service.

6.17.1.3 County, Municipal and School District Taxation and Debt. Counties and municipalities generally issue bonds to fund major public improvement projects. General non-revenue-producing facilities, such as streets, fire protection facilities and parks, are financed by the sale of general obligation (G.O.) bonds. G.O. bonds are promissory notes at a specified interest rate that are repaid from municipal ad valorem taxes. School districts issue school bonds that are similar to G.O. bonds in that they are repaid from school ad valorem taxes.

Public facilities that produce revenues, such as hospitals, water, sewer, electric and gas facilities, are commonly funded by the sale of revenue bonds. Revenue bonds are similar to G.O. bonds, except that they are repaid from the revenues of the facility for which the bonds were issued.

A measure of additional bonding capacity is the ratio of current indebtedness to assessed valuation. Generally, a ratio of 10 percent or less indicates that a community can issue additional G.O. (or school) bonds to finance public improvements (Parish, 1981). Project area counties, cities and school districts are well within this standard.

Project area cities have financed water, sewer, and hospital facilities with revenue bonds. Coverage, or the ratio of annual surplus revenues to annual debt payment, is commonly used as an indicator of a city's ability to issue additional revenue bonds; a coverage of 1.5 or more surplus/debt payment requirements is considered acceptable (Parish, 1981). Coverage in the project area communities ranges from 1.7 to 2.0.

6.17.2 Impacts of No Action Alternative

No impacts for the project to local community finances would occur under the "no action" alternative.

6.17.3 Impacts of Project Alternatives

The operation of the proposed mine would generate increased tax revenues for state, county and municipal governments and local school districts. Local taxing jurisdictions would benefit from ad valorem taxes on both the capital value of the mine and worker residential property, as well as sales taxes resulting from increased consumer spending. Actual tax revenues would depend ultimately on future tax rates and assessment procedures.

Based upon 1980-81 tax rates (1.44), the $70 million (1988 dollars) capital value of the proposed mine is expected to generate approximately $1.2 million per annum in property taxes beginning in 1988 with full mine operation, a substantial beneficial impact over the long term to Rusk County. The Henderson Independent School District would also benefit by taxing the mine.

Residential property taxes would vary among jurisdictions. Residential property currently assessed at $50,000 and located within the jurisdiction of Rusk County, the Town of Henderson and the Henderson Independent School District (ISD) would be taxed $1,282 per year. The same piece of property subject to the jurisdictional authority of Gregg County, the City of Longview and the Longview ISD would be taxed $627. In general, the 91 new single-family units expected to be needed for the project-related in-migrating population could potentially generate more than $90,000 in annual residential property taxes based upon tax rates and assessed valuation for the above-mentioned taxing entities.

Based upon an average annual per capita taxable retail expenditure of approximately $3,000, the project-related population could potentially add between $25,000 and $75,000 in local sales tax revenues annually during the long-term operation of the mine.

Based upon the anticipated in-migrating population distribution among project area communities, only Henderson and, to a lesser extent, Tatum would need to finance additional water treatment improvements. Based upon current bonding capacities, no significant, adverse impact is expected. The anticipated beneficial impacts to community finances may be slightly lessened by potential need for increased expenditures of tax revenues for items such as public safety, public transportation and water utility expenditures.

6.18 CUMULATIVE IMPACTS

This analysis of cumulative impacts concentrates on a six-county region (Cherokee, Gregg, Harrison, Panola, Rusk and Smith counties) and eight projects. The projects are:

(1) Martin Lake "D" Area Mine (Rusk County);
(2) MLSES and mining areas "A", "B" and "C" (Panola and Rusk counties);
(3) Darco Mine and plant (Harrison County);
(4) Henry W. Pirkey Power Plant and South Hallsville Mine (Harrison County);
(5) Proposed power plant and mine (Harrison County);
(6) Proposed Troup Project, Mine and facility (Cherokee and Smith counties);
(7) Dolet Hills Power Plant and Mine (De Soto Parish, Louisiana); and
(8) Castor Bayou Mine (De Soto Parish, Louisiana).

The analysis concentrates on these energy development projects but non- energy projects also are considered. The analysis is quantitative where possible, but the lack of data and the widespread area (4,967 square miles) prevent quantification of many items.

6.18.1 Geology and Topography

Impacts to geology and topography are generally site specific. The six-county area is located in the West Gulf Coast Plain section of the Gulf Coastal Plain physiographic province (Sec. 6.1.1). Topography is primarily gently undulating to rolling hills. The affected geologic units are recent alluvial deposits, Carrizo formation and the undifferentiated Wilcox. The mine projects would cause site specific adverse impacts to less than 100,000 acres of presently undisturbed geologic units. This represents about 3.1 percent of the six-county acreage (3,206,400 acres). The projects could also cause interruption of petroleum production in all six counties as well as loss of localized deposits of sand, gravel and clay.

6.18.2 Soils and Prime Farmland

The regional soils tend to be loamy or sandy and are generally acidic. About 658,685 acres of prime farmland soils exist in the region (EPA, 1981b). On a county basis, Smith County is lowest (8.0 percent of the county acreage) and Panola is highest (33 percent). It can be estimated that the projects located within the region (project nos. 1, 2, 3, 4, 5 and 6) might adversely affect as much as 25,000 acres of prime farmland soils, or about 3.8 percent of the total six-county acreage. In addition to direct impacts from these energy-related projects, impacts from induced urban development and industrial growth around population centers also adversely affect prime farmland soils but the acreage involved is much smaller.

6.18.3 Ground-water Resources

The ground-water systems in the region which are affected are primarily Carrizo and upper Wilcox units. These sand units are characterized by being relatively thin and usually discontinuous. Power plants normally have a minimal effect on these shallow water-bearing sand bodies. Mining disturbs the units physically (overburden removal) and has further impacts from dewatering. Recharge of the spoil would take from 10 to 20 years (or more) depending upon site specific factors. Chemical analysis of overburden at several mine sites in the area indicates that contamination of ground water by constituents leached from overburden should not be a problem. If contamination did occur, the concentration plume should reach steady-state conditions within about one mile outside of the project boundary.

6.18.4 Surface-water Resources

The area of concern for potential surface-water impacts is Segments 505 and 504 of the Sabine River. All eight of the projects would discharge into one of the two segments. Generally, present water quality in these segments is good. Although none of the total mileage (109.2) of Segment 505 met water quality standards in 1980, only contact recreation was restricted as a potential use. The primary water quality problem in both segments is dissolved oxygen. Segment 505 receives effluents from municipal and industrial sources which contribute to the low dissolved oxygen. No information is available on sediment buildup or contaminants in sediment. No particular chemical constituents presently constitute a problem, although the Sabine River Authority has recommended a monitoring program and has expressed concern about energy development projects. Strict compliance by the energy projects with Federal and state effluent limitations should minimize the adverse impacts that occur from such projects to surface-water quality.

6.18.5 Ecology

This area of gently rolling, wooded hills is dissected by tributaries of the Sabine River, which crosses the area. No estimate of the total wetland acreage for the six counties exists but the Sabine and its major tributaries contain many acres. Bottomland forest and upland forests are also widespread. The total forest acreage in the region (EPA, 1981b) is about 1,620,742 acres which is 50.5 percent of the total regional acreage. The six projects physically in the region could remove as much as approximately 35,000 acres of forest land (2.2 percent of total forest). Some of this acreage (and some non-forested acreage) would be wetlands. These affects on regional vegetation constitute a long-term adverse impact to the vegetational communities of the region and to wildlife by physically removing high-value wildlife habitat. In general, only minor short-term adverse impacts would occur to the aquatic biota and habitats. Several of the projects (including Martin Lake "D") contain plans for stream diversions and these project components constitute localized long-term, adverse impacts. Three threatened or endangered species (the Bald

Eagle, American Alligator and Red-cockaded Woodpecker) potentially occur in this region. A biological assessment to determine impacts is necessary for each project. Cumulatively, the projects reduce potential habitat for these species and could directly affect some of the species. The American Alligator is the only species for which a "may affect" determination has been made (two projects).

6.18.6 Archaeological and Historical Resources

As of 1980, over 1,000 archaeological and historical sites had been recorded from the region. These included 27 sites on the NRHP (EPA, 1981b).

Since 1980, more detailed studies have been conducted at several of the proposed project sites. Each project requiring Federal permit action (all of these projects) would require identification of these cultural resources, determination of effect and appropriate mitigation. EPA has reduced costs to applicants by developing a Memorandum of Agreement among the Federal permitting agency, the Advisory Council on Historic Preservation and the Texas State Historic Preservation Officer to allow for identification surveys and mitigation to be completed over the long mining project life. A determination of effect would be conducted for each NRHP or NRHP-eligible site and suitable mitigation would be developed as necessary. The projects would cause long-term significant adverse impacts and irretrievable losses to the resource. Where the significance of properties is protected through data recovery, excavation, etc., some long-term beneficial impacts of increasing public knowledge may occur.

6.18.7 Air and Sound Quality

A dispersion modeling study was done in 1979 to determine the cumulative impacts to regional air quality from the MLSES. All major point sources within a 31-mile radius were considered. Addition of the "D" Area mine or other mines to this region will not affect the results of that study. New power plants would receive a PSD permit only if emissions in the area would remain within standards. The six regional projects represent a long-term adverse impact to regional air quality but the total emissions of particulates, SO_2 and NO_x would remain within standards, which provide for protection to public health. Cumulative impacts of radioactive emissions from regional power plants and surface lignite mines are not expected to be significant. Power plant emissions (gases and particulate matter emitted at stack-top level) will have a maximum annual impact within five kilometers (3.1 miles) of the stacks. Mining operation emissions will impact at points immediately adjacent to the mining area and will decrease rapidly with distance. The greatest cumulative impacts from all the sources will be found close-in to the individual sources and will be attributable almost entirely to those individual sources. The increases in the existing radionuclide concentrations resulting from the operation of the individual power plants and mines are expected to be small (as shown previously in the impacts section) and will become much smaller with distance. Therefore, radioactive emissions from these projects are expected to have negligible public health consequences.

6.18.8 Land Use and Recreation

The six-county region is composed of about 43.0 percent agricultural/rangeland and 50.5 percent forestland (EPA, 1981b). An undetermined amount of the forestland is used for grazing purposes. The power plants and mine facilities represent long-term changes in land use. The actual areas to be mined represent long-term adverse impacts to vegetative cover types but not necessarily to land use. The majority of mined areas would be returned to agricultural use after the bonding period. Short-term impacts to hunting would occur since the mining companies would probably restrict access to land they control. Minor, long-term impacts would result from removal of high-value game species habitat and replacement by habitat of lower value.

6.18.9 Socioeconomics

The six-county region is largely rural in nature with scattered population centers. The proposed energy development projects would create an influx of individuals to fill employment positions with the projects and additional persons would migrate into the region to fill positions created as secondary effects. The number and impacts of these in-migrants are dependent upon such factors as timing of the project, size of the project, existing labor pool, general economic health of the region, etc. It is not possible to predict the exact impacts caused by these projects. In general, localized areas within the region might experience adverse impacts to housing availability, educational facilities, public services and the transportation facilities. Beneficial impacts would occur to the local economics, individual's salaries and community finances. Two of the eight projects (MLSES including mining areas and the Darco facilities) are presently in operation and present socioeconomic conditions include their adverse and beneficial impacts. Two of the projects (the proposed plant/mine in Harrison County and the Troup project) one in planning stages and one not scheduled to begin in the near future. The remaining four projects are all scheduled to begin within the next four years. If all began construction (and then operations) in the same year, the adverse impacts mentioned above would occur generally over the whole region (but would be centered primarily around each of the projects). It is possible that the impacts from one or more of the projects could combine to cause more severe impacts in localized areas.

7.0 COORDINATION

Coordination with other Federal agencies, state agencies and the public are set forth in EPA's implementation procedures on NEPA (44 FR 64174-64193) and in public participation final regulations (44 FR 10286-10297).

7.1 SCOPING PROCESS

A notice of intent to prepare an EIS on the issuance of an NPDES permit for the proposed Martin Lake "D" Area project was issued by EPA, Region 6, on December 18, 1981. Federal, state and local agencies, and the public were invited to participate in the process for determining the scope of issues to be addressed and for identifying the significant issues related to the proposed action. A public meeting to receive input was held on January 28, 1982, at the Rusk County Courthouse in Henderson, Texas.

7.2 EIS REVIEW PROCESS

A notice of availability of this Draft EIS in the Federal Register initiates a 45-day comment period during which comments are solicited from Federal, state and local agencies, groups and individuals. A public hearing will be scheduled. After the comment period and public hearing, and after comments have been responded to by EPA, the Final EIS will be prepared and distributed. Comments will be received during a 30-day comment period. After consideration of comments, EPA will make a decision on the NPDES permit action. A Record of Decision will then be issued.

7.3 DISTRIBUTION OF THE EIS

The Draft EIS was distributed to agencies, organizations and individuals for review and comment. In addition, copies are available at the Rusk County Memorial Library, (Henderson, Texas), the Rusk County Courthouse (Henderson, Texas), the Gregg County Courthouse (Longview, Texas) and to individuals upon request.

7.3.1 Federal Agencies

U. S. Forest Service, Regional Planner, Albuquerque, New Mexico
U. S. Forest Service, Regional Environmental Coordinator, Atlanta, Georgia

U. S. Department of Energy, Washington, D.C.

U. S. Department of Energy, Dallas Support Office, Dallas, Texas

U. S. Department of the Interior, Office of Environmental Project Review
Washington, D.C.

U. S. Department of the Interior, Regional Environmental Officer
Albuquerque, New Mexico

National Park Service, Outdoor Recreation Planner
Albuquerque, New Mexico

National Park Service, Division of Environmental Services
Santa Fe, New Mexico

U. S. Fish and Wildlife Service, Area Manger, Austin, Texas

U. S. Fish and Wildlife Service, Environmental Specialist
Atlanta, Georgia

U. S. Army Corps of Engineers, Fort Worth, Texas

U. S. Army Corps of Engineers, Dallas, Texas

U. S. Department of Agriculture, Washington, D.C.

U. S. Department of Agriculture, Agriculture and Environmental Sciences
Austin, Texas

U. S. Department of Agriculture, Soil Conservation Service
Temple, Texas

Department of Health and Human Services, Center for Disease Control
Atlanta, Georgia

Department of Health and Human Services, Region 6 Public Health Service
Dallas, Texas

U. S. Department of Transportation, Office of Environment and Safety
Washington, D.C.

Federal Emergency Management Agency, Region 6, Denton, Texas

U. S. Department of Interior, Office of Surface Mining, Denver, Colorado

U. S. Bureau of Mines, Intermountain Field Operations, Denver, Colorado

USDA Farmers Home Administration, Temple, Texas

U. S. Department of Housing and Urban Development, Fort Worth, Texas

Federal Aviation Administration, Planning Section, Fort Worth, Texas

Agriculture Stabilization and Conservation Service, Washington, D.C.

Federal Highway Administration, Office of Environment and Design
Fort Worth, Texas

Federal Energy Regulatory Commission, Regional Engineer
Fort Worth, Texas

U. S. Coast Guard, 8th District, New Orleans, Louisiana

Bureau of Land Management, Planning and Environmental Coordinator
Santa Fe, New Mexico

U. S. Geological Survey, Water Resources Division, Austin, Texas

U. S. Bureau of Reclamation, Amarillo, Texas

U. S. Department of Commerce, Office of Coastal Zone Management
Washington, D.C.

7.3.2 State Agencies and Organizations

Railroad Commission of Texas, Surface Mining and Reclamation Division
Austin, Texas

Texas Parks and Wildlife Department, Austin, Texas

Texas Historical Commission, Austin, Texas

Texas Water Resources Institute, College Station, Texas

Texas Energy and Natural Resources Council, Austin, Texas

Texas Air Control Board, Austin, Texas

Texas Department of Community Affairs, Austin, Texas

Texas Committee on Natural Resources, Dallas, Texas

Texas State Soil and Water Conservation Board, Temple, Texas

Texas Department of Health Resources, Austin, Texas

Texas Department of Water Resources, Austin, Texas

Texas Department of Highways and Public Transportation, Austin, Texas

Governors Office of Planning and Budget, Austin, Texas

Honorable Mark White, Governor of Texas, Austin, Texas

Honorable Lloyd Bentsen, U. S. Senate, Washington, D.C.

Honorable John Tower, U. S. Senate, Washington, D.C.

7.3.3 Public Groups

Association of Texas Soil and Water Conservation Districts

American Lung Association of Texas

Audubon Society, Central Texas and Southwest Region

Beautify Texas Council

Beta Beta Beta Biological Club

Citizens Environmental Coalition

Common Cause

Environmental Defense Fund

League of Women Voters of Texas

Nature Conservancy, Texas Chapter

Sierra Club of Texas

Soil Conservation Society of America

Society of American Foresters

Sportsman's Club of Texas
Texas Archaeological Society
Texas Conservation Council
Texas Environmental Coalition
Texas Organization for Endangered Species
Texas Water Conservation Association
Wild Lands Preservation Society
Wildlife Management Institute

7.3.4 Distribution of the Final EIS and Record of Decision

The Final EIS will be distributed to those who comment on the Draft EIS and to those who request a copy. The Record of Decision will be distributed to the project mailing list.

8.0 LIST OF PREPARERS

This environmental impact statement was prepared by EH&A for the U. S. EPA, Region 6. Key personnel from EH&A and EPA include:

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10.0 GLOSSARY

ACID DRAINAGE
Water with a pH of less than 6.0 and in which total acidity exceeds total alkalinity, discharged from an active, inactive or abandoned surface coal mine and reclamation operation or from an area affected by surface coal mining and reclamation operations.

ACID-FORMING MATERIALS
Earth materials that contain sulfide minerals or other materials which, if exposed to air, water or weathering processes, form acids that may create acid drainage.

ACID SOIL
Generally, a soil that is acid throughout most or all of the parts of it that plant roots occupy. Commonly applied to only the surface-plowed layer or to some other specific layer or horizon of a soil. Practically, this means a soil more acid than pH 6.6; precisely, a soil with a pH value less than 7.0. A soil having a preponderance of hydrogen over hydroxyl ions in the soil solution.

ACID SPOIL
Usually spoil material containing sufficient pyrite so that weathering produces acid water and the pH of the soil determined by standard methods of soil analysis is between 4.0 and 6.9.

ACRE-FOOT
A term used in measuring the volume of water, equal to the quantity required to cover 1 acre 1 ft in depth, or 43,560 cu ft.

ADJACENT AREA
Land located outside the affected area, permit area or mine plan area, depending on the context in which adjacent area is used, where air, surface or ground water, fish, wildlife, vegetation or other resources may be adversely impacted by surface coal mining and reclamation operations.

AFFECTED AREA
With respect to surface mining activities, any land or water upon or in which those activities are conducted or located.

AGRICULTURAL USE
The use of any tract of land for the production of animal or vegetable life. The uses include, but are not limited to, the pasturing, grazing and watering of livestock, and the cropping, cultivation and harvesting of plants.

AIR POLLUTION
The action of making air physically impure or unclear; contaminating air with man-made waste.

AIR QUALITY, AMBIENT
Condition or quality of the surrounding air.

AIR QUALITY CONTROL REGION
Any interstate area or major intrastate area designated by the Administrator of the Environmental Protection Agency (or his authorized representative) which he deems

necessary or appropriate for the attainment and maintenance of ambient air quality standards.

ALKALINE SOIL

Generally, a soil that is alkaline throughout most or all of the parts of it occupied by plant roots; although the term is commonly applied to only a specific layer or horizon of a soil. Precisely, any soil horizon having a pH value greater than 7.0. Practically, a soil having a pH above 7.3.

ALKALINITY (Total)

The capacity of a water to neutralize acids. Alkalinity in water is caused primarily by bicarbonates, carbonates and hydroxides, and is expressed as equivalent calcium carbonate ($CaCO_3$).

AMMONIA NITROGEN

That portion of the total nitrogen in a water sample made up of free ammonia.

APPROXIMATE ORIGINAL CONTOUR

Surface configuration achieved by backfilling and grading of the mined areas so that the reclaimed area, including any terracing or access roads, closely resembles the general surface configuration of the land prior to mining and blends into and complements the drainage pattern of the surrounding terrain, with all highwalls, spoil piles and coal refuse piles eliminated.

AQUIFER

1. A water bearing formation through which water moves more readily than in adjacent formations with lower permeability.
2. A zone, stratum or group of strata that can store and transmit water in sufficient quantities for a specific use.

AREA STRIP MINING

Surface mining which is not narrowly confined by topographic or overburden depth characteristics and which typically covers relatively large tracts on gently rolling to relatively flat terrain. Mineral is removed by digging a series of parallel trenches with spoil material being placed in the cut made during the previous pass.

AVAILABLE WATER

The part of the water in the soil that can be taken up by plants at rates significant to their growth.

BACKFILL

The operation of refilling an excavation. Also the material placed in an excavation in the process of backfilling.

BENCH

The surface of an excavated area at some point between the material being mined and the original surface of the ground on which equipment can set, move or operate. A working road or base below a highwall as in contour stripping for coal.

BOX CUT

The initial cut driven in a property, where no open side exists; this results in a highwall on both sides of the cut.

BUCKETWHEEL EXCAVATOR

A continuous digging machine composed of a boom on which is mounted a rotating vertical wheel having buckets on its periphery. As the rotating wheel is pressed into the material to be excavated, the buckets scoop material and discharge it onto a conveyor belt system for transport to loading or dump sites.

BUFFER STRIPS

1. Unaffected areas between the mining operation and areas designated for other public and private use.
2. Strips of grass or other erosion-resisting vegetation between or below surface or auger mining disturbances.

CAST

In mining, to place spoil materials with a dragline.

CATION EXCHANGE CAPACITY

The sum total of exchangeable cations that a soil can adsorb. Sometimes called "total exchangeable capacity," "base-exchange capacity" or "cation adsorption capacity," expressed in milliequivalents per 100 grams of soil or other adsorbing material.

CHLORIDE

A compound in which chlorine is combined with another element or radical.

CHLOROPHYLL a

One of two forms of Chlorophyll that produces the green pigment found in the chloroplasts of plant cells ($C_{55}H_{72}MgN_4O_5$).

COLOR (true)

The measure of a water's tinge. The color unit is produced by one milligram per liter of platinum in the form of the chloroplatinate ion. Color is expressed in units of the platinum-cobalt scale.

CONCENTRATION (water quality usage)

The amount of a substance occurring in a given amount of water - common unit is parts per million (ppm) or milligrams per liter (mg/l).

CRITICAL HABITAT

See HABITAT, CRITICAL.

CUMULATIVE IMPACT

See IMPACT, CUMULATIVE.

DISCHARGE (flow)

The quantity of water moving past a specific point in a stream. Measured by a specific flow-measuring device.

DISSOLVED OXYGEN

The extent to which oxygen occurs in solution in water or wastewater; usually expressed as concentration, in parts per million, or percent of saturation.

DISSOLVED SOLIDS

The difference between the total suspended solids in water and the residue from evaporation.

DISTURBED AREA

An area where vegetation, topsoil or overburden is removed or upon which topsoil, spoil, coal processing waste, underground development waste or noncoal waste is placed by surface coal mining operations. Those areas are classified as disturbed until reclamation is complete and the performance bond or other assurance of performance is released.

DIVERSION

1. Channel constructed across the slope for the purpose of intercepting surface runoff. Changing the accustomed course of all or part of a stream. Also, a ditch or canal by which water is diverted from one stream to another.
2. A channel, embankment or other man-made structure constructed to divert water from one area to another.

DRAGLINE

An excavating machine that utilizes a bucket operated and suspended by means of lines or cables, one of which hoists or lowers the bucket from a boom; the other, from which the name is derived, allows the bucket to swing out from the machine or to be dragged toward the machine for loading. Mobility of draglines is by crawler mounting or by a walking device for propelling, featuring pontoon-like feet and a circular base or tub. The swing of the machine is based on rollers and rail. The machine usually operates from the highwall.

DRAINAGE BASIN

The area from which water is carried off by a drainage system, a watershed or a catchment area.

EMISSION

A discharge of pollutants into the environment, generally used in regard to releases into the atmosphere.

ENVIRONMENT

All external conditions that may act upon an organism or soil to influence its life, development and ultimately the organism's survival; including sunlight, temperature, moisture and other organisms.

ENVIRONMENTAL IMPACT ASSESSMENT

An evaluation and objective prediction of the environmental impacts of a proposed action using a systematic, interdisciplinary approach that integrates social and natural sciences and environmental design arts.

ENVIRONMENTAL IMPACT STATEMENT (EIS; Environmental Statement; 102 Statement)

A document prepared by a Federal agency in which anticipated environmental effects of a planned Federal course of action or development are evaluated. A Federal statute (Section 102 of the National Environmental Policy Act of 1969) requires that such statements be prepared. It is prepared first in draft or review form and, then, in a final form. An impact statement includes the following points:

1. the environmental impact of the proposed action,
2. any adverse impacts that cannot be avoided by the action,
3. the alternative courses of action,
4. the relationships between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
5. a description of the irreversible and irretrievable commitment of resources that would occur if the action were accomplished.

ENVIRONMENTAL IMPACT STATEMENT, DRAFT (DEIS; Draft Environmental Statement; DES)

The version of the statement of environmental effects required for major Federal actions under Section 102 of the National Environmental Policy Act (NEPA), and released to the public and other agencies for comment and review. It is a formal document which must follow the requirements of NEPA, the Council on Environmental Quality (CEQ) Guidelines, and directives of the agency responsible for the project proposal. Since the adoption of state and local laws modeled after NEPA, this term has also been used to refer to similar statements required to comply with those laws. See ENVIRONMENTAL IMPACT STATEMENT; ENVIRONMENTAL IMPACT STATEMENT, FINAL.

ENVIRONMENTAL IMPACT STATEMENT, FINAL (FEIS; Final Environmental Statement; FES)

The final version of the statement of environmental effects required for major Federal actions under Section 102 of the National Environmental Policy Act (NEPA). It is a revision of the draft environmental impact statement to include public and agency responses to the draft. It is a formal document that must meet legal requirements and is the document used as a basis for judicial decisions concerning compliance with NEPA. This term is also used for similar statements prepared to comply with state and local laws patterned after NEPA. See ENVIRONMENTAL IMPACT STATEMENT; ENVIRONMENTAL IMPACT STATEMENT, DRAFT.

EROSION

The wearing away of the land surface by running water, wind, ice or other geological agents, including such processes as gravitational creep. Detachment and movement of soil or rock fragments by water, wind or ice, or gravity.

FECAL COLIFORM

Aerobic bacillus which is present in the excrement of warm blooded animals. The coliform group is considered a reliable indicator of the treatment for bacterial pathogens.

FLOOD, 10-YEAR

The flow of a stream which has been equaled or exceeded, on the average once in 10 years (or other designated period).

FUGITIVE DUST

That particulate matter not emitted from a duct or stack which becomes airborne due to the forces of wind or surface coal mining and reclamation operations or both. During surface coal mining and reclamation operations it may include emissions from haul roads; wind erosion of exposed surfaces, storage piles and spoil piles; reclamation operations; and other activities in which material is either removed, stored, transported or redistributed.

GROUND WATER

Subsurface water occupying the saturation zone, from which wells and springs are fed. In a strict sense, the term applies only to water below the water table. Also called plerotic water; phreatic water.

HABITAT, CRITICAL

Any air, land or water area, including any elements thereof, that the Secretary of the Interior, through the Director, U. S. Fish and Wildlife Service or National Marine Fishery Service, has determined is essential to the survival of wild populations of a listed species or to its recovery to a point at which the measures provided pursuant to the Endangered Species Act of 1973 are no longer necessary. Such determinations are published in the Federal Register.

HAUL ROAD

Road from pit to loading dock, tipple, ramp or preparation plant used for transporting mined material by truck.

HEAVY METALS

Metallic elements of high molecular weight, generally toxic to plant and animal life in low concentrations. Such metals are often residual in the environment and exhibit biological accumulation. Examples include mercury, chromium, cadmium, arsenic and lead.

HISTORIC LANDS

Historic or cultural districts, places, structures or objects, including archeological and paleontological sites, National Historic Landmark sites, sites listed on or eligible for listing on a State or National Register of Historic Places, sites having religious or cultural significance to native Americans or religious groups or sites for which historic designation is pending.

HISTORICALLY USED FOR CROPLAND

1. Lands that have been used for cropland for any five years or more out of the 10 years immediately preceding the acquisition, including purchase, lease or option of the land for the purpose of conducting or allowing through resale, lease or option the conduct of surface coal mining and reclamation operations;

2. lands that the regulatory authority determines, on the basis of additional cropland history of the surrounding lands and the lands under consideration, that the permit area is clearly cropland but falls outside the specific 5-years-in-10 criterion, in which case the regulations for prime farmland may be applied to include more years of cropland history only to increase the prime farmland acreage to be preserved; or

3. lands that would likely have been used as cropland for any 5 out of the last 10 years, immediately preceding such acquisition but for the same fact of ownership or control of the land unrelated to the productivity of the land.

HYDROLOGY

The science that relates to the water systems of the earth.

IMPACT

An observed effect that occurs in the environment as the result of some disturbance.

IMPACT, CUMULATIVE

The sum of a variety of environmental changes and their total effect resulting from several facilities (i.e., energy-development projects) over time.

IMPACT, DIRECT (Primary Impact)

Direct or primary impacts are those in which the causative agent impinges directly upon the responding ecological components, e.g., land clearing for construction causes direct loss of vegetation.

IMPACT, INDIRECT (Secondary or Tertiary Impact)

Indirect or secondary effects are those in which man-caused change in the environment creates one or more intermediary effects in a chain of events leading to the observation of the impact.

IMPACT, LONG-TERM AND SHORT-TERM

These terms refer to the relative duration of an impact. No strict definition of the relative time frames involved in short- and long-term impacts exists, so a time frame should be specified whenever either word is used. Generally, long-term impacts are those lasting for the duration of the project or longer. Short-term impacts are generally those lasting only during the construction phase or occuring for brief periods during the operation of the facility.

IMPACT, SIGNIFICANT

Any impact resulting in measurable changes in indicator parameters or community dynamics (such as reduced primary production).

INFILTRATION

The process of water entering the ground water system through the land surface.

LAND USE (RRC definitions)

Specific uses or management-related activities, rather than the vegetation or cover of the land. Land uses may be identified in combination when joint or seasonal uses occur.

a. Cropland means land used for the production of adapted crops for harvest, alone or in a rotation with grasses and legumes, and includes row crops, small grain crops, hay crops, nursery crops, orchard crops and other similar specialty crops. Land used for facilities in support of cropland farming operations which is adjacent to or an integral part of these operations is also included for purposes of these land use categories.

b. Pastureland or land occasionally cut for hay. Land used primarily for the long-term production of adapted, domesticated forage plants to be grazed by livestock or occasionally cut and cured for livestock feed. Land used for facilities in support of pastureland or land occasionally cut for hay which is adjacent to or an integral part of these operations is also included.

c. Grazingland. Includes both grasslands and forest lands where the indigenous vegetation is actively managed for grazing, browsing or occasional hay production. Land used for facilities in support of ranching operations which are adjacent to or an integral part of these operations is also included.

d. Forestry. Land used or managed for the long-term production of wood, wood fiber or wood-derived products. Land used for facilities in support of forest harvest and management operations which is adjacent to or an integral part of these operations is also included.

e. Residential. Includes single- and multiple-family housing, mobile home parks, and other residential lodgings. Land used for facilities in support of residential operations which is adjacent to or an integral part of these operations is also included. Support facilities include, but are not limited to, vehicle parking and open space that directly relate to the residential use.

f. Industrial/Commercial. Land used for:

1. Extraction or transformation of materials for fabrication of products, wholesaling of products for long-term storage of products. This includes all heavy and light manufacturing facilities such as lumber and wood processing, chemical manufacturing, petroleum refining, and fabricated metal products manufacture. Land used for facilities in support of these operations which is adjacent to or an integral part of that operation is also included. Support facilities include, but are not limited to, all rail, road and other transportation facilities.

2. Retail or trade of goods or services, including hotels, motels, stores, restaurants and other commercial establishments. Land used for facilities in support of commercial operations which is adjacent to or an integral part of these operations is also included. Support facilities include, but are not limited to, parking, storage or shipping facilities.

g. Recreation. Land used for public or private leisure-time use, including developed recreation facilities such as parks, camps and amusement areas, as well as areas for less intensive uses such as hiking, canoeing and other undeveloped recreational uses.

h. Fish and Wildlife Habitat. Land dedicated wholly or partially to the production, protection or management of species of fish or wildlife.

i. Developed Water Resources. Includes land used for storing water for beneficial uses such as stockponds, irrigation, fire protection, flood control and water supply.

j. Undeveloped Land or No Current Use or Land Management. Land that is undeveloped or, if previously developed, land that has been allowed to return naturally to an undeveloped state or has been allowed to return to forest through natural succession.

LAND USE, REGIONAL (USGS definitions)

a. Cropland. Land in tillage rotation, orchards and land formerly used for crops which has not been purposely converted to another use. Lands used for hay meadows are included in cropland.

b. Pasture. Lands producing forage plants, principally introduced species for animal consumption. In addition to regulating the intensity of grazing, management practices would usually include one or more cultural recurring treatments such as reseeding, renovation, reestablishment, mowing, liming or fertilization. Pasture lands may also be unimproved natural grasslands used for forage.

c. Range. Lands in which the natural potential (climax) plant cover is composed principally of native grasses, forbs and shrubs. Other than brush control, management is primarily achieved by regulating the intensity of grazing and seasonal use.

d. Forest Land. Lands which (1) are at least 10 percent stocked by forest trees of any size and capable of producing timber or other wood products, or capable of exerting an influence on the water regime; (2) lands from which the trees described in (1) have been removed to less than 10 percent stocking and which have not been developed for other uses; (3) afforested (planted) areas; and (4) chaparral areas may be commercial, non-commercial or forest land grazed.

e. Urban or Built-up Areas. Areas that include cities, villages and built-up areas of more than 4.04 ha (10 ac). Also includes road and railroad acres, industrial sites, railroad yards, cemeteries, airports, golf courses, institutional and public administrative sites.

f. Water Areas. Includes ponds and lakes of more than .81 ha (2 ac). Also includes rivers and streams that are less than one-eighth mile wide.

g. Other Land. Non-Federal land not classified as cropland, pasture and range, forest woodland or urban and built-up.

LEACHING

Extraction of dissolved or suspended materials from a solid by a liquid.

LIGNIN

An amorphous, cellulose-like, organic substance which acts as a binder for the cellulose fibers in wood and certain plants and adds strength and stiffness to cell walls.

LINE SINK

A linear hydrologic outflow boundary such as a mine highwall, or flow to an infinitely long line of wells.

Mg/l

Abbreviation for milligrams per liter, which is a weight to volume ratio commonly used in water quality analysis. It expresses the weight in milligrams of a substance occurring in one liter of liquid.

METRIC, CONVERSION TO

(See Table G-1, pg. 10-14.)

MINE DRAINAGE

Any water forming on or discharging from a mining operation, including runoff and seepage. May be alkaline or acid in nature.

MINE-MOUTH PLANT

A steam-electric plant or coal gasification plant built close to a coal mine; usually associated with delivery of output via transmission lines or pipelines over long distances, as contrasted with plants located nearer load centers and at some distance from sources of fuel supply.

MITIGATION

1. Avoiding the impact altogether by not taking a certain action or parts of an action.
2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
3. Rectifying the impact by repairing, rehabilitating or restoring the affected environment.
4. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.

NEUTRALIZATION POTENTIAL

The amount of neutralizing bases, including carbonates, present in overburden materials.

NITRATE NITROGEN

That portion of total nitrogen in water which contains the NO_3^+ ion.

NONPOINT SOURCE

Any nonconfined area from which pollutants are discharged into a body of water, i.e., agricultural runoff, urban runoff and sedimentation from construction sites.

OVERBURDEN

1. Soil, rock and other materials which overlie mineral deposits and are removed in surface mining.
2. Material of any nature, consolidated or unconsolidated, that overlies a coal deposit, excluding topsoil.

PALEONTOLOGICAL SITES

An area known to possess fossil forms of plants or animals.

pH

The symbol or term refers to a scale commonly used to express the degrees of acidity or alkalinity. On this scale of pH of 1 is the strongest acid, pH of 14 is the strongest alkali, pH of 7 is the point of neutrality at which there is neither acidity or alkalinity. pH is not a measure of the weight of acid or alkali contained in or available in a given volume.

PIT

Used in reference to a specifically describable area of open cut mining. May be used to refer to only that part of the open cut mining area from which coal is being actively removed or may refer to the entire contiguous mined area.

POLLUTANT

Any contaminant that, when present in the air or water, detracts from or interferes with the desired use or natural state of that air or water.

POTENTIAL ACIDITY

The amount of acidity produced by the potential oxidation of pyrite in all of its crystalline forms.

PRIME FARMLAND

Those lands which are defined by the Secretary of Agriculture in 7 CFR 657 (Federal Register Vol. 4 No. 21).

PRODUCTIVITY

1. Agricultural - the capacity of a soil to produce a certain kind of crop under a defined set of management conditions.

2. Ecological - the rate of growth or weight addition or energy storage by the organisms in an ecosystem.

PYRITE

A yellowish mineral, iron disulfide, FeS_2, generally metallic appearing; also known as "fool's gold."

RECLAMATION (Rehabilitation)

1. The process of reconverting mined or other disturbed land to its former or other productive uses.

2. The process of making a site habitable to organisms that were originally present or others that approximate the original inhabitants.
3. Those actions taken to restore mined land to a postmining land use approved by the regulatory authority.

REVEGETATION

Reestablishment and maintenance of growth or plants to replace original ground cover following land disturbance.

RUNOFF

That portion of the rainfall that is not absorbed by the deep strata: is utilized by vegetation or lost by evaporation or may find its way into streams as surface flow.

SEDIMENT

Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity or ice and has come to rest on the earth's surface either above or below sea level.

SEDIMENTATION POND

A primary sediment control structure including but not limited to a barrier, dam or excavated depression which slows down water runoff to allow sediment to settle out.

SELENIUM

A trace element which in elemental form is practically non-toxic, however hydrogen selenide and other selenium compounds are extremely toxic.

SIDE CAST

To move spoil material to the side, generally within a 45 degree angle.

SPECIES

Rare -	A species not commonly found in a given area due to its habitat requiements, small population size, or discrete distributional patterns, etc.
Threatened -	A species whose future existence is jeopardized in the foreseeable future because its habitat is threatened with destruction, drastic modification or severe curtailment, or for other reasons such as over-exploitation, disease, pollution, predation, etc.
Endangered -	A species whose continued existence is in immediate peril because of critically low or declining populations.
Unique -	A species only found in a particular area, region or hahitat type.
Game -	Any animal harvested or taken for food or sport.

SPECIES DIVERSITY

The number and abundance of species in an ecosystem.

SPECIFIC CONDUCTANCE

The measurement of conductance of a material between opposite sides of a cube, one centimeter in each direction.

SPOIL

1. The overburden or non-coal material removed in gaining access to the coal or mineral material in surface mining.
2. Overburden that has been removed during surface coal mining operations.

STRIP MINE

Refers to a procedure of mining which entails the complete removal of all material from over the product to be mined in a series of rows or strips; also referred to as "open cut," "open pit" or "surface mine."

SULFATE

A compound in which the hydrogen of sulfuric acid is replaced by either a metal or by an organic radical.

SURFACE MINING

Mining method whereby the overlying materials are removed to expose the mineral for extraction.

SUSPENDED SOLIDS

Sediment which is in suspension in water but which will physically settle out under quiescent conditions (as differentiated from dissolved material).

TANNIN

A yellowish, astringent substance ($C_{14}H_{10}O_9$) or any of a number of similar substances derived from oak bark, gallnuts, etc., that impart a brown color to water.

TEMPERATURE

The degree of hotness or coldness of anything, usually as measured on a thermometer.

TOPSOIL

Presumed fertile soil material -- used as a top dressing. Distinction has been made among synthetic, weathered and geologic topsoil. Synthetic topsoil can include sand and stone chips as well as fly ash, sawdust or manure not usually a part of geological soil and rock. Weathered topsoil is the natural top-dressing material that has been subjected to weathering throughout geologic time.

TOTAL DISSOLVED SOLIDS

Theoretically, the anhydrous (dry) residues of the dissolved constituents in water.

TOTAL ORGANIC CARBON

A direct measure of carbon, which is the major constituent of organic matter.

TOTAL SUSPENDED SOLIDS

The amount of solids, both organic and inorganic, in suspension in the water.

TURBIDITY

The reduction of transparency of water due to the presence of suspended particulate matter. Such material may consist of clay or silt, finely divided organic matter or microscopic organisms which cause light to be scattered and absorbed rather than transmitted in straight lines through the sample.

VOLATILE SUSPENDED SOLIDS

Those suspended solids volatilized when the glass fiber filter from the suspended solids determination is ignited in a furnace at 550° C.

WATER QUALITY

A term used to describe the chemical, physical and biological characteristics of water in respect to its suitability for a particular use.

WATER TABLE

The upper surface of the ground water or that depth below which the soil is saturated with water where the body of ground water is not confined by an overlying zone of very slowly permeable material.

TABLE G-1
METRIC CONVERSION FACTORS
(International System of Units)

Quantity	Symbol	English	Multiply by	Metric	Symbol
Length					
	in	inches	2.54	centimeters	cm
	ft	feet	30.48	centimeters	cm
	yd	yard	0.91	meters	m
	mi	miles	1.61	kilometers	km
Area					
	in^2	square inches	6.45	square centimeters	cm^2
	ft^2	square feet	0.09	square meters	m^2
	yd^2	square yards	0.84	square meters	m^2
	mi^2	square miles	2.59	square kilometers	km^2
	ac	acre	0.41	hectares	ha
Mass (weight)					
	oz	ounces (avdp)	28,350.00	milligrams	mg
	oz	ounces (avdp)	28.35	grams	g
	lb	pounds	0.45	kilograms	kg
	tons	short tons (2,000 lbs)	0.91	tons (metric)	tons
Temperature					
	°F	Fahrenheit degrees	5/9 (after subtracting 32)	Celsius degrees	°C
Pressure					
	psi	pounds per square inch	703.07	kilograms per square meter	kg/m^2
Volume					
	fl oz	fluid ounces	29.573	milliliters	ml
	qt	quarts	0.946	liters	liters
	gal	gallons	3.785	liters	liters
	ft^3	cubic feet	0.028	cubic meters	m^3
	yd^3	cubic yards	0.765	cubic meters	m^3
	bbl	barrels (oil)	0.159	cubic meters	m^3
	ac-ft	acre-feet	1,233.487	cubic meters	m^3
Speed (velocity)					
	ft/s	feet per second	0.3048	meters per second	m/s
	ft/s	feet per second	0.0003	kilometers per second	km/s
	ft/min	feet per minute	0.5080	centimeters per	cm/s
	mi/hr	miles per hour	0.4470	meters per second	m/s
	mi/hr	miles per hour	1.6093	kilometers per hour	km/hr
	mi/hr	miles per hour	0.8684	knots	kts
Energy					
	Btu	British thermal units	0.0002928	kilowatt hours	KWh
	hp	horse power	0.74570	kilowatts	kw
Flow Rate					
	gal/min	gallons per minute	0.0630907	liters per second	liters/sec
	gal/d	gallons per day	0.0037854	kiloliters per day	kl/da
	tpy	tons per year	0.9071850	metric tons per year	tpy
	cfs	cubic feet per second	0.0283170	cubic meters per second	m^3/s

APPENDIX A

Evaluation of the Discharge of Dredged and Fill Material in Compliance with Section 404(b)(1) Guidelines (40 CFR 230)

SUBPART A - APPLICABILITY

The discharge of dredged and fill material into waters of the United States at several specific sites would be required for the successful completion of this project. The activities requiring the discharge of dredged and fill material would include mining lignite beneath wetlands; a temporary stream diversion; construction of haul roads, an 11.5-mile railroad spur and an 11.5-mile transmission line; and the relocation of existing pipelines and transmission lines around mining areas. More details on the exact location and extent of these activities are discussed in the EIS (Sec. 5.2).

SUBPART B - COMPLIANCE WITH GUIDELINES

On the basis of these Guidelines, the proposed disposal sites for discharge of dredged or fill material are proposed as complying with the requirements of the Guidelines with the inclusion of general, practicable mitigative measures (Subpart H) to minimize adverse effects to the affected aquatic ecosystem (detailed project plans are presented in the EIS, Sec. 5.2).

SUBPART C - POTENTIAL IMPACTS ON PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM

Channel morphology in the project area exhibits a pool-riffle pattern in most area streams with the dominant habitat type being silt-bottomed pools. Stream substrates consist of silts, sands and gravels (EIS, Sec. 6.7.1.1). The discharge of dredged and fill materials should have only minor overall impacts to the substrates in project area although adverse impacts would occur at specific sites (EIS, Sec. 6.7.3). The temporary (24 months) diversion of a portion of Dry Creek (about 2,000 feet) and destruction of about 84 acres of wetlands (EIS, Fig. 6-15) would cause the most severe localized impacts (EIS, Sec. 6.7.3).

The content of suspended particulates in project area streams varies greatly depending upon location, flow, time of year and precipitation events (EIS, Sec. 6.4.1.3). Construction and mining activities associated with the project would temporarily increase the level of suspended particulates in localized areas. The increases would be short term and the relative amount of increase, water level, flow regime and seasonal timing would be such that no significant long-term adverse impacts to the aquatic ecosystem would occur (EIS, Secs. 6.4.3.1, 6.4.3.2, 6.4.3.4, 6.7.3).

Project activities should have only minor short-term impacts on water in the area (Sec. 6.4.3.4). There may be minor changes in the clarity, color, odor or taste of the water and any contaminants would be introduced in insignificant quantities under normal conditions (EIS, Sec. 6.4.3.4). The introduction of nutrients (fertilizers) should be minor and no significant adverse impacts would be expected (EIS, Sec. 6.7.5).

Present characteristics for water circulation and normal water fluctuations are addressed in the EIS (Sec. 6.4.1.2). Surface-water modeling by the consultant indicates that project activities should not significantly affect water circulation since mining, the stream diversion and all construction activities are proposed to conform to applicable state and Federal regulations (including the Texas Coal Mining Regulations) which specify requirements for the protection of the hydrologic balance (EIS, Secs. 5.2, 6.4.3.1, 6.4.3.2). The project activities would affect the runoff volumes and peak flows during and after mining. The runoff volume would increase slightly and peak flows would decrease slightly because of the action of sedimentation ponds (EIS, Secs. 6.4.3.1, 6.4.3.2). The impacts to the hydrologic regime would be minor, long-term and beneficial (see Subpart D for potential effects on stream biota).

SUBPART D - POTENTIAL IMPACTS ON BIOLOGICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM

No threatened or endangered species occur in the project area and project activities would have no effect on any threatened or endangered species or on any Critical Habitat (EIS, Sec. 6.8). Analysis of the aquatic organisms in the project area (EIS, Sec. 6.7.1.2) shows that planktonic organisms occur in low numbers and moderate species diversity while macroinvertebrates were present in moderate to high numbers but species diversity varies widely depending on location. The abundance and diversity of fish communities are limited by the generally small sizes of the streams and limited habitat diversity. Impacts from project activities could occur as a result of destruction of habitat (Dry Creek diversion, mining wetlands, construction for stream crossings), increased suspended particulates, changes in stream hydrologic regimes, increased nutrient loads, changes in ground-water recharge regimes and as a result of the loss of riparian vegetation along some stream segments. These impacts are thoroughly discussed in Sec. 6.7.3 of the EIS. While impacts from all these possible sources would occur, overall the impacts would be of short duration and primarily localized. The most significant impacts with the longest duration would occur during the temporary diversion of approximately 2,000 feet of Dry Creek. The diversion would remove all existing habitat, cause adverse effects downstream by increasing the level of suspended particulates and would remove the riparian vegetation along that segment of Dry Creek. The diversion would be in place approximately two years, at which time Dry Creek would be returned to its approximate original channel. Thus, impacts to the aquatic ecosystem of Dry Creek would occur twice within a short time. The impacts associated with both diversions would be locally severe but short term. Recolonization by aquatic biota should occur within a few months and since the channel morphology and substrate in the new channel should not differ significantly from the predisturbance channel, the impacts would not be significant. The long-term impacts caused by small changes in runoff volume and peak discharges would be minor (EIS, Sec. 6.7.3).

The areal extent of impacts to the aquatic ecosystem would be relatively small, localized and would occur sequentially over the life of the mine (approximately 30 years). Impacts to other wildlife which depend upon the aquatic ecosystem would, therefore, be short term and minor (EIS, Sec. 6.6.3.2).

SUBPART E - POTENTIAL IMPACTS ON SPECIAL AQUATIC SITES

The special aquatic sites within the project area are wetlands and riffle and pool complexes. As discussed in the EIS (Sec. 6.5.1), about 850 acres of wetlands occur within the project boundary. The greatest acreage of these wetlands (EIS, Fig. 6-14) are associated with the flood plains of Mill and Tiawichi creeks and the major tributaries of Mill Creek (Todd Branch, Boggy Branch, Dry Creek and Dogwood Creek). Other wetland acreage occurs in scattered locations throughout the project area. Only about 84 acres (9.4 percent) of these wetlands would be directly affected by mining while a presently undetermined acreage of wetlands, which are part of about 20.4 acres of bottomland forest within the rights-of-way, might be affected by construction of the railroad and transmission line. The remaining acreage would be subject to varying degrees of indirect impacts. Indirect impacts from increased suspended particulates would be short term at any one location and would be minor. Impacts from dewatering, time required for groundwater recharge, increased runoff and decreased peak flows would be long-term, adverse impacts. These impacts would be significant in localized areas in the upper reaches of such tributaries as Boggy and Dry creeks and Todd Branch but would be minor impacts to the lower reaches of the tributaries and to Mill and Tiawichi creeks.

Direct impacts would result from destruction of wetland acreage for construction or mining activities and during the diversion of Dry Creek (EIS, Secs. 6.5.3.1, 6.5.3.2). These adverse impacts would be long term since this would represent the loss of 84 acres of wetlands for many years. The project might result in the creation of as much as 80 acres or more of new wetland acreage, but development of any such acreage to a value equivalent to the acreage now existing could take 30 years or more.

Long-term, significant, adverse impacts would occur to the important functions (such as water purification, flood control, nutrient recycling and use as high quality habitat) of wetlands within the project boundary. These impacts would occur primarily in localized areas of wetlands along the upper portions of tributaries. The most severe impacts would result from direct loss and from dewatering (EIS, Sec. 6.5.3.2). Short-term minor impacts would occur to the function of the large systems of wetlands within the flood plains of Mill and Tiawichi creeks.

Riffle and pool complexes would be affected in localized areas by construction activities related to haul roads, the railroad spur, transmission line, etc. The most severe impacts would be associated with the 2,000-foot diversion of Dry Creek (EIS, Sec. 6.7.3). While locally significant, the minor amount of direct disturbance to area streams would ensure that there would be only minor adverse impacts to the riffle and pool system in this portion of the Mill Creek - Tiawichi Creek watersheds. Impacts from sedimentation by suspended particulates would be minor.

SUBPART F - POTENTIAL EFFECTS ON HUMAN USE CHARACTERISTICS

No significant, long-term adverse impacts to the quality or quantity of ground-water for human use would occur (EIS, Sec. 6.3.3). Short-term impacts could result from removal of wells but these wells would be either compensated for or replaced. Public supply wells would not be affected and any interruption of the supply lines would be compensated for or the lines replaced. Project activities would have no significant effects on either supply or quality of surface water (EIS, Sec. 6.4.3). Neither the quality nor quantity of water in Lake Cherokee would be affected significantly as long as wetlands remain essentially as they are, in extent, physical characteristics and quality of vegetation, continuing to serve as a buffer zone to the lake.

The recreational and commercial fisheries in the area are extremely limited, as discussed in Sec. 6.7.1 of the EIS. Use of the streams and stock tanks in the area is restricted either because of limited physical access, private ownership or both. In addition, the generally small size and restricted habitat diversity in streams restricts the fish population. Thus, as pointed out in the EIS (Sec. 6.7.3), no significant adverse impacts to recreational or commercial fisheries or water-related recreation would occur because of project activities. The reclamation requirements imposed by the RRC regulations should ensure that no distracting disposal sites would be left nor would inappropriate development or unplanned or incompatible human use of the area result.

SUBPART G - EVALUATION AND TESTING

Borrow sources for construction of the access road for the mine, stream reroutes and various haul roads would be located generally within the area immediately adjacent to the proposed structures. Exact locations and size of borrow areas for the structures would have to be adjusted as construction progresses and more detailed investigations on quantity and quality of materials became available. In all other instances, material would first be removed and then replaced, including construction of the transmission facilities, the relocation of pipelines and transmission facilities, and during actual mining operations. The excavation and placement of fill would be accomplished using conventional heavy equipment (bulldozers, draglines, hauling and compaction equipment, front-end loaders, scrapers and backhoes) typically used for excavation, road construction and mining operations. The rate of construction and the actual timing of the movement and discharge of material would depend on development of final design, plans and specifications, contract advertisement and award, and weather conditions.

Native soils and parent geologic materials represent the primary source of dredged and/or fill material. It would be substantially the same in composition and contaminant levels as the substrate on which it would be discharged. The use of this material in project construction and operation should not significantly alter contaminant levels at any of the discharge sites. 40 CFR 230.60(c) states that "Where the discharge site is adjacent to the extraction site and subject to the same sources of contaminants, and materials at the two sites are substantially similar, the fact that the material to be discharged may be a carrier of contaminants is not likely to result in degradation of the disposal site. In such circumstances, when dissolved material and suspended particulates can be controlled to prevent carrying pollutants to less contaminated areas, testing will not be required." All discharge sites would be expected to meet these requirements. Measures to ensure the stability of project fills would include compaction, revegetation, proper slope design and the use of concrete or riprap stabilization as required.

As discussed in the EIS (Secs. 6.1.1, 6.2.3.3, 6.2.3.5, 6.3.1.3, 6.3.3.3), the physical and chemical makeup of the materials potentially dredged and used as fill (the overburden) have been analyzed previously (EIS, Appendix D). The analyses show that none of the chemical constituents are present in concentrations which would cause contamination of either ground water or surface water under mining or construction conditions. Mining may bring pyritic material to localized areas on the surface and expose it to oxidizing conditions. This potential for acidic conditions and possible release of heavy metals would be controlled by liming to reduce acidity, placing a layer of soil over the exposed area or by completely removing and replacing the area (EIS, Sec. 6.2.3.3). Additional support for these conclusions is provided by the results of tests and monitoring in the nearby (about 10 miles) Martin Lake "A", "B" and "C" mining areas which contain similar materials (EIS, Sec. 6.2.3.3). The results do not show that any contamination has occurred although hot spots and erosion do occur. It should be noted that no stream sediment analysis has been done nor has any biomonitoring in the areas after mining.

SUBPART H - ACTIONS TO MINIMIZE ADVERSE EFFECTS

The following actions are proposed whenever practicable to minimize adverse effects on the aquatic ecosystem:

(1) Within engineering constraints, discharge and fill sites would be designed to confine the material to minimize smothering organisms. This could include the use of standard techniques such as check dams, dikes and vegetative sediment filters.

(2) Sedimentation ponds would be designed to avoid a disruption of periodic water inundation patterns since although peak discharges from precipitation events would be delayed, they would not be prevented.

(3) Sedimentation ponds would be constructed to reduce the amount of suspended particulates reaching downstream areas during non-precipitation conditions.

(4) The discharges during non-precipitation conditions would be managed to confine and minimize the release of suspended particulates giving decreased turbidity levels and maintaining light penetration for organisms. Discharges during precipitation events would contain greater levels of suspended particulates. Flooding should remain essentially unchanged except peak flows would be slightly less.

(5) Denuded areas would be revegetated to reduce erosion.

(6) Stream crossings by roads and the railroad would be designed to maintain the hydrologic regime; i.e., the stream channel would not be constructed and channel morphology and slope would be unchanged.

(7) During reclamation, some sedimentation ponds could be left intact which would increase the amount of available aquatic habitat in the area.

APPENDIX B

**Advisory
Council On
Historic
Preservation**

1522 K Street, NW
Washington, DC 20005

MEMORANDUM OF AGREEMENT

WHEREAS, the Environmental Protection Agency has determined that construction and operation of the Martin Lake Area "D" Surface Lignite Mine may have an effect upon properties eligible for, and potentially eligible for, inclusion in the National Register of Historic Places and has requested the comments of the Advisory Council on Historic Preservation, pursuant to Section 106 of the National Historic Preservation Act (16 U.S.C. 470) and its implementing regulations, "Protection of Historic and Cultural Properties" (36 CFR Part 800),

NOW, THEREFORE, the Environmental Protection Agency, the Texas State Historic Preservation Officer, and the Advisory Council on Historic Preservation agree that the undertaking shall be implemented in accordance with the attached proposal in order to take into account the effect of the undertaking on historic properties.

Execution of this Memorandum of Agreement evidences that the Environmental Protection Agency has afforded the Council a reasonable opportunity to comment on the construction and operation of the Martin Lake Area "D" Surface Lignite Mine and its effects on historic properties and that the Environmental Protection Agency has taken into account the effects of its undertaking on historic properties.

Robert Garvey Aug 26, 1982
Executive Director (date)
Advisory Council on Historic Preservation

Alexander Aldrich 8/31/82
Chairman (date)
Advisory Council on Historic Preservation

PROPOSAL FOR AGREEMENT

I. EPA will incorporate by reference the following conditions into the original and appropriate subsequent NPDES permits for Texas Utilities Generating Company's Martin Lake Area "D" mine project.

A. Prior to any ground disturbing activities, Texas Utilities Generating Company (TUGCO) will complete an intensive historic and cultural survey to ensure the identification of all National Register or eligible properties that may be affected directly, or indirectly, by the subsequent mining and related activities, in accordance with the standards in 36 CFR Part 66 Appendix B (proposed guidelines)(copy attached). Generally, the intensive surveys will be conducted in coordination with 5-year permit areas. TUGCO will develop an investigation strategy plan in consultation with the Texas SHPO, for review and approval. Unless the Texas SHPO notes an objection within 15 working days after receipt, the survey may proceed. If the SHPO notes an objection, the matter will be resolved before a survey proceeds.

B. TUGCO shall provide sufficient documentation to the Texas SHPO about the historic and cultural properties identified by the survey(s) to enable the SHPO to assess the eligibility of the property for inclusion in the National Register of Historic Places. Site forms which include locational information shall be provided to the SHPO on a monthly basis as field survey work proceeds.

C. Should the Texas SHPO determine that a property does not meet the criteria for inclusion in the National Register, TUGCO will identify the property on the detailed project plans and then no special protection need be afforded the property when encountered during construction or mining.

D. Should a property be found to meet the criteria for inclusion in the National Register, and where it is not possible to avoid or to protect it from subsequent construction and/or mine related activities, TUGCO will, prior to any ground disturbing activity in the vicinity of the property, treat the property as follows:

1. If the property is significant (as documented in the nomination to or determination of eligibility for the National Register) primarily in the data it contains so that retrieval of the data in an appropriate manner may preserve this significance, TUGCO, in consultation with.the Texas SHPO, will develop and implement a data recovery program in accordance with the Council's Handbook for the Treatment of Archeological Properties (attached). TUGCO will submit a data recovery plan to the Texas SHPO for review and approval prior to its implementation and prior to initiating any action that would affect the property. Unless the SHPO notes an objection within 15 working days after receipt, the plan may be implemented. If the SHPO notes an objection, the matter will be resolved before a plan is implemented.

2. If the property is significant (as documented in the nomination to or determination of eligibility for the National Register) primarily for architectural or historical values, TUGCO will consult with the Texas SHPO to develop a mutually acceptable program which is to be implemented by TUGCO to ensure preservation, relocation, and/or recordation of the property. If the property is to be relocated or otherwise rehabilitated and preserved, the mitigation program will conform to the Secretary of the Interior's Standards for Rehabilitation.

   Prior to demolition or alteration of any such property, TUGCO will record the property so that there will be a permanent record of its present appearance and its history. TUGCO will first contact the National Architectural and Engineering Record (NAER) (National Park Service, Department of the Interior, 5000 Marble Street, N.E., Albuquerque, New Mexico, 87110, or telephone 505-766-5944) to determine what documentation is required. All documentation must be accepted in writing by NAER prior to demolition or alteration of the property. TUGCO will also provide copies of this documentation to the Texas SHPO.

E. TUGCO will ensure that all survey, evaluation, data recovery, mitigation measures and monitoring will be conducted under the direct supervision of a person(s) who meet, at a minimum, the applicable professional qualifications set forth in 36 CFR Part 66 (proposed guidelines). TUGCO's consulting archeologist will be present during ground disturbing activities where it can be predicted that subsurface cultural material is likely to occur. TUGCO's consulting archeologist will train ground disturbing equipment operators to recognize cultural properties should any occur in areas where they were not previously predicted.

F. TUGCO will stop activities that would adversely affect a historic or cultural property that is discovered during construction or mining related operations until the Texas SHPO has been given an opportunity to inspect the property, and whatever preservation or recovery measure that is agreed upon has been completed. Two working days should be allowed for this inspection.

G.. TUGCO will provide a draft copy of all reports to the Texas SHPO for review and comment. All reports of work accomplished will meet, in content and in form, standards generally expected by historic preservation professionals as portrayed in proposed guidelines 36 CFR Part 66.

H. TUGCO will provide at least two copies of final reports to the Texas SHPO. A copy of any final technical reports will also be furnished to Interagency Archeological Services (Department of the Interior, Washington, D.C. 20243) for possible submission to the National Technical Information Service (NTIS). Any precise locational data must appear in a separate appendix and will be withheld from NTIS publication pursuant to Section 11 of the General Authorities Act of 1970, as amended (Public Law 94-453). A copy of any final report will also be furnished to EPA.

TUGCO will ensure that all notes, photographs, negatives, and processed data (tables, maps, etc.) will be stored in good order and in a manner that makes them available for future study at the University of Texas at Austin or other appropriately accredited institution that meets the standards set forth in the proposed 36 CFR Part 66 and that makes these data available for other parties research or other appropriate purposes.

II. Upon written notice from the Texas SHPO or the Council that any of the conditions of this agreement are being violated, EPA, the Texas SHPO and the Council shall consult to determine how the concern should be resolved.

III. If a signatory determines that the terms of this Agreement cannot be met or believes a change is necessary, the signatory shall immediately request the consulting parties to consider an amendment of the Agreement. Amendments will be executed in the same manner as the original Agreement.

Frances E. Phillips 7.12.82
Environmental Protection Agency (date)

Curtis Tunnell
Texas State Historic Preservation Officer

APPENDIX C

Preliminary

Permit No. TX0091120
Application No. TX0091120

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1251 et. seq; the "Act"),

Texas Utilities Generating Company
2001 Bryan Tower
Dallas, Texas 75201

is authorized to discharge from a facility located at Martin Lake Mining Area D, near Henderson, Rusk County, Texas

to receiving waters named the Sabine River via Mill, Martin and Tiawichi Creeks

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof.

This permit shall become effective on

This permit and the authorization to discharge shall expire at midnight,

Signed this day of

Myron O. Knudson, P.E.
Director, Water Management Division (6W)

PART I
REQUIREMENTS FOR NPDES PERMITS

SECTION A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. Outfall 001

During the period beginning the effective date and lasting through the expiration date

the permittee is authorized to discharge from Outfall(s) serial number(s) 001, intermittent discharge from various retention ponds**..

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations			
	kg/day(lbs/day)		Other Units (Specify)	
	Daily Avg	Daily Max	Daily Avg	Daily Max
Flow-m^3/Day(MGD)	N/A	N/A	*	*
Total Suspended Solids	N/A	N/A	35.0 mg/l	70.0 mg/l
Iron, Total	N/A	N/A	3.0 mg/l	6.0 mg/l
Manganese, Total	N/A	N/A	* mg/l	* mg/l

Effluent Characteristic	Monitoring Requirements	
	Measurement Frequency	Sample Type
Flow-m^3/Day(MGD)	One/day	Estimate***
Total Suspended Solids	One/day****	Grab
Iron, Total	One/day****	Grab
Manganese, Total	One/day****	Grab

* Report
** See Part III, Paragraph B
*** See Part III, Paragraph E
**** When Discharge occurs

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored one/day**** by grab sample.

There shall no no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): At the flow measuring device prior to discharge to a tributary of the Sabine River.

2. Outfall 002

During the period beginning the effective date and lasting through the expiration date

the permittee is authorized to discharge from Outfall(s) serial number(s) 002, discharge from a sewage treatment plant.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations			
	kg/day(lbs/day)		Other Units (Specify)	
	Daily Avg	Daily Max	Daily Avg	Daily Max
Flow-m^3/Day(MGD)	N/A	N/A	*	*
Total Suspended Solids	N/A	N/A	30 mg/l	45 mg/l
Biochemical Oxygen Demand (5-day)	N/A	N/A	30 mg/l	45 mg/l

Effluent Characteristic	Monitoring Requirements	
	Measurement Frequency	Sample Type
Flow-m^3/Day(MGD)	1/week	Grab
Total Suspended Solids	1/week	Grab
Biochemical Oxygen Demand (5-day)	1/week	Grab

* Report

The pH shall not be less than 6.0 standard units nor greter than 9.0 standard units and shall be monitored 1/week by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Prior to discharge from the treatment plant to Martin Creek.

SECTION B. SCHEDULE OF COMPLIANCE

The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

NONE

PART II
STANDARD CONDITIONS FOR NPDES PERMITS

SECTION A. GENERAL CONDITIONS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

2. Penalties for Violations of Permit Conditions

The Clean Water Act provides that any person who violates a permit condition implementing sections 301, 302, 306, 307, 308, 318, or 405 of the Clean Water Act is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions implementing sections 301, 302, 306, 307, or 308 of the Clean Water Act is subject to a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than 1 year, or both.

3. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

5. Toxic Pollutants

Notwithstanding paragraph A-4, above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be modified or revoked and reissued to conform to the toxic effluent standard or prohibition and the permittee so notified.

The permittee shall comply with effluent standards or prohibitions established under section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

6. Civil and Criminal Liability

Except as provided in permit conditions on "Bypassing" Section B, Paragraph B-3 and "Upsets" Section B, Paragraph B-4, nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

8. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. Property Rights

The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of the permit.

2. Duty to Halt or Reduce Activity

Upon reduction, loss, or failure of the treatment facility, the permittee shall, to the extent necessary to maintain compliance with its permit, control production or all discharges or both until the facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power of the treatment facility fails or is reduced or lost. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

3. Bypass of Treatment Facilities

a. Definitions

(1) "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.

(2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs c and d of this section.

c. Notice

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass.

(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in Section D, Paragraph D-6 (24-hour notice).

d. Prohibition of bypass.

(1) Bypass is prohibited and the Director may take enforcement action against a permittee for bypass, unless:

(a) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(b) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if the permittee could have installed adequate backup equipment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(c) The permittee submitted notices as required under paragraph c of this section.

(2) The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed above in paragraph d(1) of this section.

4. Upset Conditions

a. Definition. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of paragraph c of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(1) An upset occurred and that the permittee can identify the specific cause(s) of the upset;

(2) The permitted facility was at the time being properly operated; and

(3) The permittee submitted notice of the upset as required in Section D, Paragraph D-6.

(4) The permittee complied with any remedial measures required under Section A, Paragraph A-3.

d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

5. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

SECTION C. MONITORING AND RECORDS

1. Representative Sampling

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples shall be taken at the monitoring points specified in this permit and, unless otherwise specified, before the effluent joins or is diluted by any other wastestream, body of water, or substance. Monitoring points shall not be changed without notification to and the approval of the Director.

2. Flow Measurements

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to insure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to insure that the accuracy of the measurements are consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of less than ± 10% from true discharge rates throughout the range of expected discharge volumes. Guidance in selection, installation, calibration and operation of acceptable flow measurement devices can be obtained from the following references:

a. "A Guide to Methods and Standards for the Measurement of Water Flow", U. S. Department of Commerce, National Bureau of Standards, NBS Special Publication 421, May 1975, 97 pp. (Available from the U. S. Government Printing Office, Washington, D. C. 20402. Order by SD catalog No. C13.10:421).

b. "Water Measurement Manual", U. S. Department of Interior, Bureau of Reclamation, Second Edition, Revised Reprint, 1974, 327 pp. (Available from the U. S. Government Printing Office, Washington, D. C. 20402. Order by Catalog No. I27.19/2:W29/2, Stock No. S/N 24003-0027).

c. "Flow Measurement in Open Channels and Closed Conduits, U. S. Department of Commerce, National Bureau of Standards, NBS Special Publication 484, October 1977, 982 pp. (Available in paper copy or microfiche from National Technical Information Service (NTIS), Springfield, VA 22151. Order by NTIS No. PB-273 535/5ST).

d. "NPDES Compliance Sampling Manual", U. S. Environmental Protection Agency, Office of Water Enforcement, Publication MCD-51, 1977, 140 pp. (Available from the General Services Administration [8FFS], Centralized Mailing Lists Services, Building 41, Denver Federal Center, Denver, CO 80225).

3. Monitoring Procedures

Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

4. Penalties for Tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

5. Reporting of Monitoring Results

Monitoring results must be reported on a Discharge Monitoring Report (DMR) form (EPA No. 3320-1). Monitoring results obtained during the previous 3 months shall be summarized for each month and reported on a DMR form postmarked no later than the 28th day of the month following the completed reporting period. The first report is due ________________. Duplicate copies of DMR's signed and certified as required by Section D, Paragraph D-11, and all other reports required by Section D, Reporting Requirements, shall be submitted to the Regional Administrator and the State at the following addresses:

Myron O. Knudson, P.E., Director
Water Management Division (6W)
U.S. Environmental Protection Agency
Region VI
First International Building
1201 Elm Street
Dallas, Texas 75270

Director, Surface Mining & Reclamation
Texas Railroad Commission
P.O. Drawer 12967, Capitol Station
Austin, Texas 78711

6. Additional Monitoring by the Permittee

If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR. Such increased frequency shall also be indicated.

7. Averaging of Measurements

Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless other wise specified by the Director in the permit.

8. Retention of Records

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

9. Record Contents

Records of monitoring information shall include:

a. The date, exact place, time and methods of sampling or measurements;

b. The individual(s) who performed the sampling or measurements;

c. The date(s) analyses were performed;

d. The individual(s) who performed the analyses;

e. The analytical techniques or methods used; and

f. The results of such analyses.

10. Inspection and Entry

The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit, and

d. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

SECTION D. REPORTING REQUIREMENTS

1. Planned Changes

The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility.

2. Anticipated Noncompliance

The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

3. Transfers

This permit is nontransferable to any person except after notice to the Director. The Director may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

4. Monitoring Reports

Monitoring results shall be reported at the intervals and in the form specified in Section C, Paragraph C-5 (Monitoring).

5. Compliance Schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date. Any reports of noncompliance shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

6. Twenty-Four Hour Reporting

The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

The following shall be included as information which must be reported within 24 hours:

a. Any unanticipated bypass which exceeds any effluent limitation in the permit.

b. Any upset which exceeds any effluent limitation in the permit.

c. Violation of a maximum daily discharge limitation for any of the pollutants listed by the Director in Part III of the permit to be reported within 24 hours.

7. Other Noncompliance

The permittee shall report all instances of noncompliance not reported under Section D, Paragraphs D-1, D-4, D-5, and D-6 at the time monitoring reports are submitted. The reports shall contain the information listed in Paragraph D-6.

8. Changes in Discharges of Toxic Substances

The permittee shall notify the Director as soon as it knows or has reason to believe:

a. That any activity has occurred or will occur which would result in the discharge of any toxic pollutant which is not limited in the permit, if that discharge will exceed the "notification levels" described in 40 CFR 122.61.

b. That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the permit application.

9. Duty to Provide Information

The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

10. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. The application should be submitted at least 180 days before the expiration date of this permit. The Director may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date.

11. Signatory Requirements

All applications, reports or information submitted to the Director shall be signed and certified.

a. All permit applications shall be signed as follows:

(1) For a corporation: by a principal executive officer of at least the level of vice-president;

(2) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.

b. All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described above.

(2) The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, or position of equivalent responsibility. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and

(3) Certification. Any person signing a document under this section shall make the following certification:

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

12. Availability of Reports

Except for data determined to be confidential under 40 CFR Part 2, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State water pollution control agency and the Regional Administrator. As required by the Act, permit applications, permits and effluent data shall not be considered confidential.

13. Penalties for Falsification of Reports

The Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

PART III
OTHER CONDITIONS

A. The "daily average" concentration means the arithmetic average (weighted by flow value) of all the daily determinations of concentration made during a calendar month. Daily determinations of concentration made using a composite sample shall be the concentration of the composite sample. When grab samples are used, the daily determination of concentration shall be the arithmetic average (weighted by flow value) of all the samples collected during that calendar day.

The "daily maximum" concentration means the daily determination of concentration for any calendar day.

B. The sampling points (sedimentation ponds) shall be numbered and reported as 101 through 991 as developed within the areas identified in the Mining Sequence Map, Figure 1-2 of the consolidated application.

C. Locations may be revised by the permittee if it becomes necessary to eliminate or establish new holding ponds. For any revision the permittee shall submit appropriate maps redesignating the holding pond location.

Any revised pond or outfall location should be consistent with and fall within the mining area boundary as defined in the applicant's State Mining Plan.

Any revised pond or outfall location shall be limited to discharging to the same receiving body of water.

D. Drainage which is not from an active mining area shall not be required to meet the limitations set forth in Part I-A of this permit as long as such drainage is not commingled with untreated mine drainage which is subject to the limitaions in Part I-A of this permit.

E. Methods of flow estimating shall be by the "California Pipe Method" as described in section 7.4.2.2. of the Handbook for Monitoring Industrial Wastewater, August 1973, U.S. Environmental Protection Agency, Technology Transfer.

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F. Effluent Limitations for Precipitation events

(a) Any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period less than or equal to the 10-year, 24-hour precipitation event (or series of storms or snowmelt of equivalent volume) may comply with the following limitations instead of the otherwise applicable limitations:

Effluent Limitations During Precipitation

Pollutant or Pollutant Property	Maximum for any one day	Average of daily values for thirty consecutive days
Settleable Solids	0.5 ml/l	N/A
pH	Within the range of 6.0 to 9.0 at all times	

(b) Any discharge or increase in volume of a discharge caused by precipitation within any 24-hour period greater than the 10-year, 24-hour event (or series of storms or snowmelt of equivalent volume) may comply with the following limitations instead of the otherwise applicable limitations:

Effluent limitations During Precipitation

Pollutant or Pollutant Property	Maximum for any one day	Average of daily values for thirty consecutive days
pH	Within the range of 6.0 to 9.0 at all times	

(c) The operator shall have the burden of proof that the discharge or increase in discharge was caused by the applicable precipitation event described in subsections (a) and (b).

G. 10-year 24-hour Precipitation Event

The term "10-year, 24-hour precipitation event" means the maximum 24-hour precipitation event with a probable recurrence interval of once in ten years as defined by the National Weather Service and Technical Paper No. 40, "Rainfall Frequency Atlas of the U.S.," May 1961, or equivalent regional or rainfall probability information developed therefrom.

H. Effluent Limitations for Reclamation Areas

The following standards apply to discharges from reclamation areas until SMCRA bond release

Effluent Limitations

Pollutant or Pollutant Property	Maximum for any one day	Average of daily values for thirty consecutive days
Settleable Solids	0.5 ml/l	N/A
pH	Within the range 6.0 to 9.0 at all times	

I. Determination of Settleable Solids

The following procedure shall be used to determine settleable solids:

Fill an Imhoff cone to the one-liter mark with a thoroughly mixed sample. Allow to settle undisturbed for 45 minutes. Gently stir along the inside surface of the cone with a stirring rod. Allow to settle undisturbed for 15 minutes longer. Record the volume of settled material in the cone as milliliters per liter. Where a separation of settleable and floating materials occurs, do not include the floating material in the reading.

The method detection limit for measuring settleable solids shall be 0.4 ml/l.

J. The Memorandum of Agreement executed by EPA, the Advisory Council on Historic Preservation, and the Texas State Historic Preservation Officer for the coal mining operation which is the subject of this permit is hereby incorporated by reference and expressly made a part of this permit. The permittee shall comply with the stipulations of such Memorandum of Agreement.

INDEX

Acid Rain	6-127
Air Quality, Existing	6-119
Air Quality, Impacts to	1-7, 6-123
Agency Alternatives	1-3, 3-1
American Alligator	6-109, Appendix K
Appendices D through L	In Depositories
Applicant, Description of	3-3
Aquatic Biology, Existing	6-102
Aquatic Biology, Impacts to	1-7, 6-105
Archaeology, Existing	6-110
Archaeology, Impacts to	1-7, 6-117
Bald Eagle	6-109, Appendix K
Bibliography	9-1
Biological Assessment (Section 7)	6-109, Appendix K
Bottomlands, Existing	6-79
Bottomlands, Impacts to	1-6, 6-79, 6-82
Bucketwheel Excavator	5-5
Clean Air Act	3-2, 6-126
Climatology	6-119
Community Finances (see individual categories)	1-8, 6-165
Community Services (see individual categories)	1-8, 6-157
Coordination	7-1
Cultural Resources (see Archaeology or Historical Resources)	6-110
Cumulative Impacts	6-167
Dewatering	1-6, 5-16, 6-39
Diversion Structures	5-16, 6-65, 6-71, 6-79
Dragline	5-6
Economy (see individual categories)	1-7, 6-146
Education	1-8, 6-158, 6-159, 6-162
EIS, Distribution	7-1
EIS, Review Process	7-1
Economic Sectors, Existing	6-147
Economic Sectors, Impacts to	6-148
Employment, Existing	6-146

Employment, Impacts to 6-148
Endangered Species Act 3-2
Environmental Consequences 1-5
EPA Alternatives 1-3, 3-1
Erosion 1-6, 5-11, 6-11, 6-14, 6-15, 6-17, 6-18, 6-21, 6-24, 6-27, 6-72
Executive Order 11990: Protection of Wetlands 3-2
Federal Water Pollution Control Act 3-2
Fire Protection 6-157, 6-161, 6-162
Fish and Wildlife Coordination Act 3-2
Flood Plains, Existing 6-79
Flood Plains, Impacts to 1-6, 6-79, 6-82
Fuel Resources 5-1
Fugitive Emissions 6-124
Geology, Existing 6-1
Geology, Impacts to 1-6, 6-8
Glossary 10-1
Ground Water, Existing 6-29
Ground Water, Impacts to 1-6, 6-38
Ground-water Recharge 1-6, 6-30
Ground-water Quality 1-6, 6-35
Ground-water Use 6-38
Habitats, Ecologically Sensitive 6-93
Health Services 6-158, 6-162
Heavy Metals 6-27, 6-35, 6-45
Historical Resources, Existing 6-115
Historical Resources, Impacts to 6-117, 6-119
Housing, Existing 6-154
Housing, Impacts to 1-8, 6-155
Income, Existing 6-147
Income, Impacts to 6-151
Issues and Concerns, Major 1-9
Lake Cherokee, Impacts to 6-71
Land Use, Existing 6-134
Land Use, Impacts to 1-7, 6-140, 6-141
Leachate 6-45

Lignite Analysis 6-4, Appendix E
Lignite Removal 5-26
Lignite Reserves 5-2, 5-18
Lignite Transportation 5-2
Memorandum of Agreement 6-119, Appendix B
Metric Conversion Table 10-14
Mining Methods 5-19
Mining Reserves 5-18
National Historic Preservation Act (Section 106) 3-2
National Register of Historic Places 6-117
No Action Alternative 1-6, 5-1
Noise (see Sound Quality)
Overburden Handling Procedures 5-7, 6-24
Particulate Emissions 6-124
Peak Flows 6-65
Police Services 6-157, 6-161, 6-162
Population, Existing 6-143
Population, Impacts to 1-7, 6-144
Prime Farmland 6-24
Prime Farmland Soils, Existing 6-15
Prime Farmland Soils, Impacts to 1-6, 6-24
Process Emissions 6-124
Project Need 4-2
Project Purpose 4-1
Project Description 5-18
Radioactive Emissions 6-127
Reclamation 5-11, 5-26, 6-27
Recreation, Existing 6-139
Recreation, Impacts to 1-7, 6-141, 6-143
Red-cockaded Woodpecker 6-109
Revegetation 5-11, 6-27
Runoff 6-65
Scoping Process 7-1
Section 404 Permit (COE) 3-1, 3-2, 5-30, 6-77
Sedimentation Ponds 5-16, 6-62
Slumping 6-8

Soils, Existing 6-9
Soils, Impacts to 1-6, 6-16
Solid Waste Disposal 5-17
Sound Quality, Existing 6-120
Sound Quality, Impacts to 1-7, 6-123, 6-128
Species, Important 6-92, 6-104
Subsidence 6-8
Surface Water, Existing 6-49
Surface Water, Impacts to 1-6, 6-62
Surface-water Quality 1-6, 6-72
Taxes, Impacts to 6-166
Terrestrial Biology, Existing 6-86
Terrestrial Biology, Impacts to 1-7, 6-94, 6-95
Threatened or Endangered Species 1-7, 6-109
Topography, Existing 6-1
Topography, Impacts to 1-6, 6-8
Transportation, Existing 6-162
Transportation, Impacts to 1-8, 6-164
Transportation Systems 5-2
TSP 6-124
Utilities 6-158, 6-162
Vegetation, Existing 6-86
Vegetation, Impacts to 1-7, 6-95
Water Control Structures 5-16
Wetlands, Existing 6-77
Wetlands, Impacts to 1-6, 6-79
Wildlife, Existing 6-89
Wildlife, Impacts to 1-7, 6-95